Vol. 3 No. 5 September/October 1987 $3.95 USA

Micro/Systems Journal™

For the Advanced Computer User

Multiuser Bulletin-Board Systems

see page 22

Also in this issue:

Numerical Processing Pitfalls in C.....12
New Turbo Pascal Support Software.....16
Review of Five Fortran Compilers for the PC 44
Putting Text and Graphics in Microsoft Windows.....58
Sun, Ethernet and PC Network File Systems.....68

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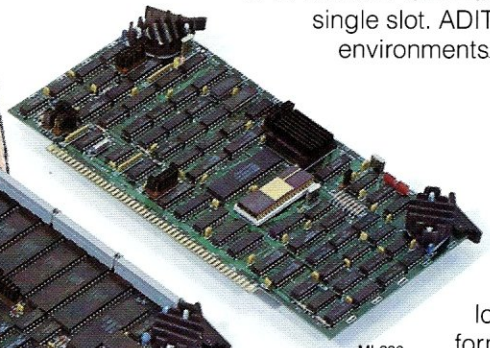

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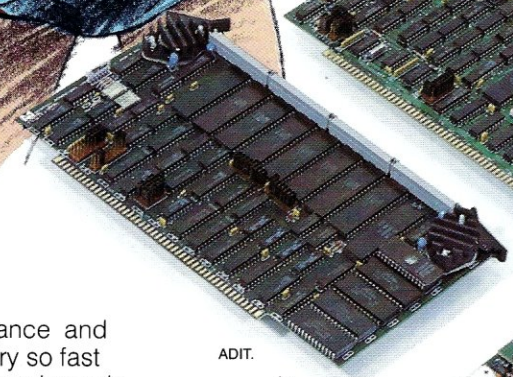

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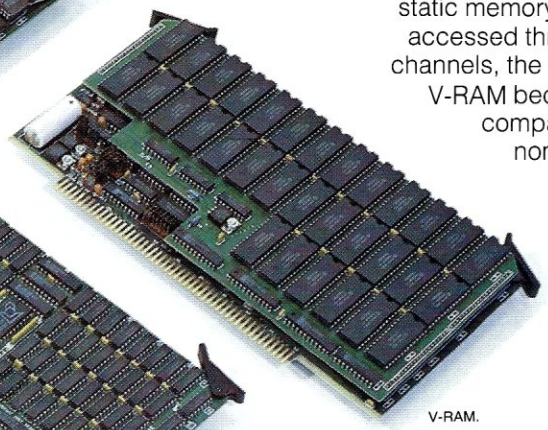

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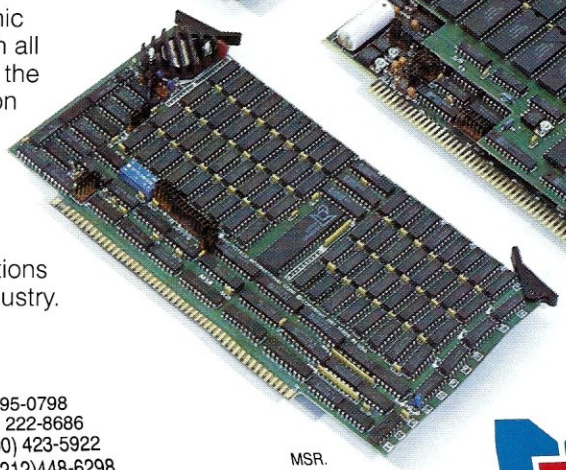

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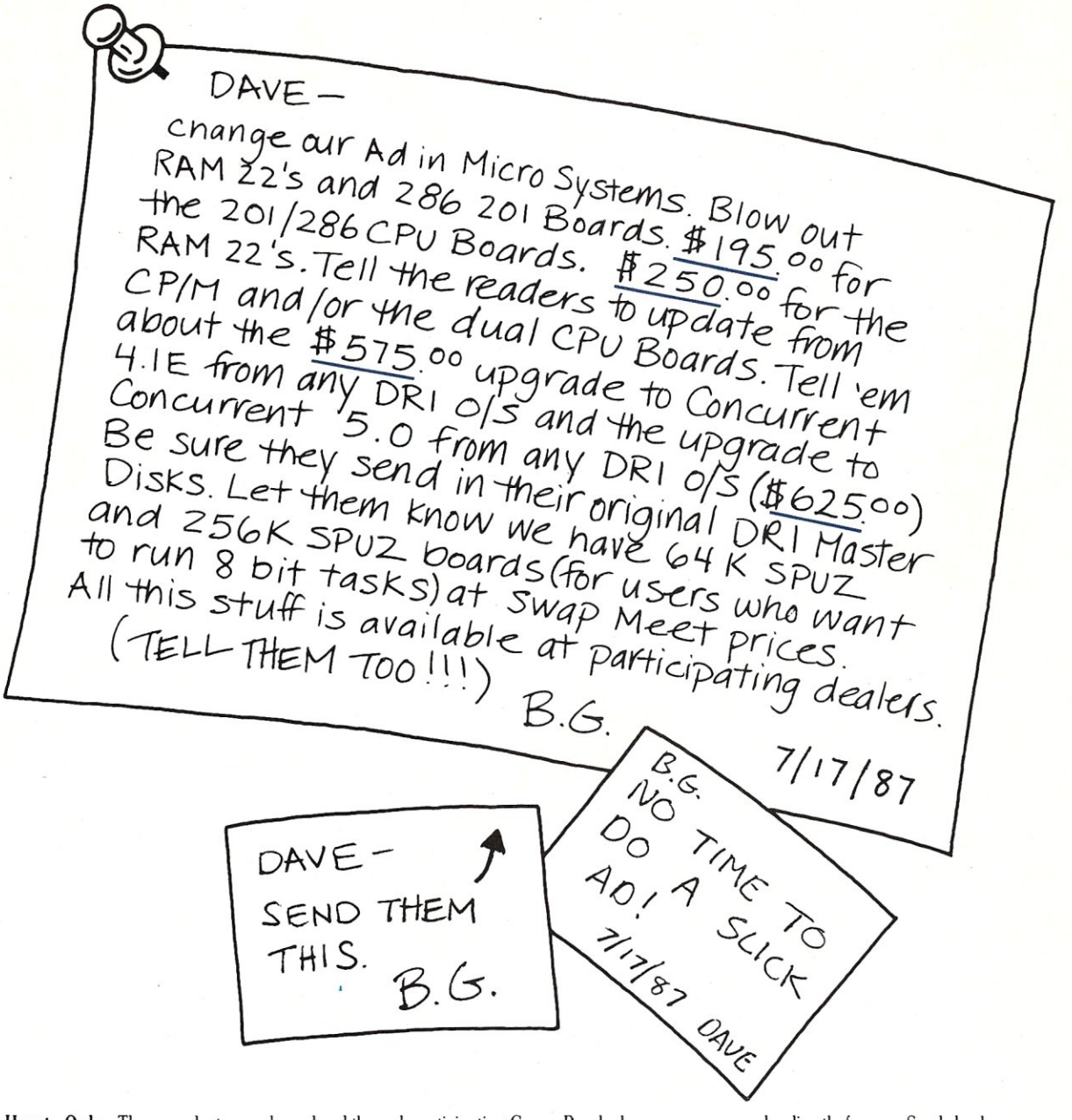

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Micro/Systems Journal (ISSN #8750-9482) is published bimonthly by M & T Publishing, Inc., 501 Galveston Dr., Redwood City, CA 94063; (415) 366-3600. Second-class postage paid at Redwood City and at additional entry points.

Article Submission: Please write the editors at Micro/Systems Journal, Box 1192, Mountainside, NJ 07092 or call (201) 522-9347 to see if there is interest in a particular subject. Please do not send the article unless we ask for it.

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Correspondence: Editorial Office: Box 1192, Mountainside, NJ 07092; (201) 522-9347. The editor may also be contacted via MCI Mail (SLIBES). Business Office: 501 Galveston Dr., Redwood City, CA 94063; (415) 366-3600.

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September/October 1987 Vol. 3 No. 5

Micro/Systems Journal™

For the Advanced Computer User

About the cover: *PC-based Multiuser bulletin-board systems are allowing more and more companies to have their users, and employees have access to on-line databases and other computer facilities. This issue features four articles on implementing such systems.* ***Cover art illustration by John Park.***

Feature Articles

Setting Up a Networking, Multiuser, Bulletin-Board System *by Steven M. Leon* **22**
A sysop's experience setting up a three-user bulletin-board system.

Program Interfacing to Microsoft Windows *by William Wong* **58**
Part V—putting text & graphics in a window.

Product Reviews

RBBS-PC *by Dave Crane* **28**
A multiuser public-domain bulletin-board system.

Bulletin-Board Systems *by Arne Strand* **32**
A summary of public-domain and commercial bulletin-board systems and tools.

DLX-BBS and DigiBoards *by Clayton D. Strand* **38**
Evaluating a nine-user bulletin-board system.

FORTRAN Compilers For The PC *by Avram Tetewsky and Dan Feenberg* **44**
A comparison of the Lahey, Microsoft, Ryan-MacFarland, Prospero, and WATCOM FORTRAN compilers.

Columns

The C Forum *by Don Libes* **12**
Pitfalls to avoid when doing numerical processing in C.

Turbo Pascal Corner *by Stephen Randy Davis* **16**
Reviews of some new Turbo Pascal support software.

The Scientific Computer User *by A. G. W. Cameron* **68**
Experiences with Sun workstations, Ethernet and the PC Network file system.

LANScape *by B. J. Hall and Michael Cherry* **72**
Part IV—Definitions of many commonly confused LAN terms.

The Public Domain Software Forum *by Charles H. Strom* **74**
Reviews two outstanding public-domain software programs: Fansi-Console and Qedit. Also the latest PC/Blue public-domain software releases.

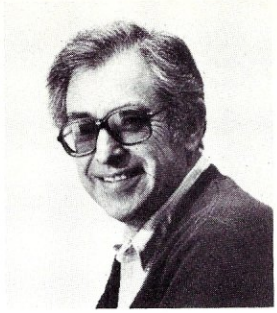
The UNIX File *by Ian F. Darwin* **78**
Dealing with the technical and personal problems of USENET, and UNIX on low-cost graphics workstations.

Departments

Editor's Page *by Sol Libes* **4**
News, Views & Gossip *by Sol Libes* **6**
Mail **10**
Classifieds **80**
The Advertiser's Index **80**

Editor's Page

Sol Libes



An Early Look at OS/2 and Operating Systems for the 386

Owners of AT systems and compatibles will soon have an operating system (OS/2) from IBM that finally exploits the features of their 80286 processors. They've only had to wait close to three years.

IBM will be releasing three versions of OS/2. OS/2, Version 1.0 of OS/2 is due in the first quarter of next year. It will overcome DOS' 640K memory limitation and will add multitasking (but not multiuser) capability. Actually, these features have been available for DOS for some time from sources other than IBM and Microsoft. However, it will not overcome DOS's 32 Mbyte size limitation.

Version 1.1 should arrive late in the year. It will add the Presentation Manager (aka Windows) and most likely features to take advantage of the PS/2 hardware.

IBM has not yet set a delivery date for the "Extended Edition" (OS/2-EE), which adds communications and the SQL database language. OS/2-EE, at $795 (site licenses are available), is aimed at IBM's primary customers—large corporate and governmental users who want to integrate desktop systems with distributed mainframe database systems.

Concurrent with the release of OS/2, Version 1.0, we should see a significant amount of OS/2 application software released. This software should run in protected mode and provide an alternative to the LIM (Lotus-Intel-Microsoft) "standard" and products such as DESQview. There is without doubt a significant need for multitasking as evidenced by the fact that Quarterdeck has reportedly shipped more than 400,000 copies of DESQview.

OS/2-EE will reportedly eat up 500-800K of memory space, which makes XENIX look small—the XENIX kernel requires only 200K. Not only that—DOS 3.2 requires a paltry 54K and DOS 2.1 (which many users are still running) requires only 25K. And, old-timers may recall when CP/M used only 12K. 500K is an awful lot of program, and although OS/2 will have gone through more than a year of field testing, we can still expect to encounter bugs. Will we see versions such as 1.01, 1.02, 1.11, 1.12, and so on?

IBM is expected to migrate many of its mainframe packages down to the micro level to run under OS/2-EE. This will allow for better connectivity between IBM mainframes and desktop systems.

80386 Operating Systems

IBM has announced it will not market an 80386 operating system until 1989, which should create a window of opportunity for operating system suppliers. In fact, we will be reviewing two early entries into the 386 operating system marketplace in the next issue (PC/MOS-386 from Software Link and Concurrent DOS-386 from Digital Research).

It is interesting to note that IBM is repeating what it did with its 286-based systems. OS/2, the operating system for its 286 machines, will be delivered almost three years after the arrival of the 286-based AT systems. And owners of IBM's new 386 systems will probably have to wait a comparable period for their operating system. Users who want to live at the cutting edge of technology have to learn considerable patience.

Could it be that IBM does not expect to sell many 386 systems compared to its 286-based systems? And that therefore a 286 operating system is of much greater importance to it? Could it be that Intel, in refusing to license manufacture of the 386 to other chip suppliers, will keep the chip's price high and thereby discourage production of 386-based systems?

Microsoft recognizes IBM's lack of interest in a 386 operating system and is not sitting still. Microsoft is expected to release a UNIX-386 late this year or early next year to run on systems such as the Compaq-386 and new IBM 386 systems. And, IBM will probably market the product. Because it is basically a product from a competitor (AT&T), however, IBM will probably market it with the same enthusiasm as it put forth for XENIX.

Microsoft will also market a 386 version of Windows, which it promises will have the ability to switch rapidly between several DOS applications running in real mode.

One thing is for sure, owners of 386 systems will not have to wait for IBM to release DOS-386. §

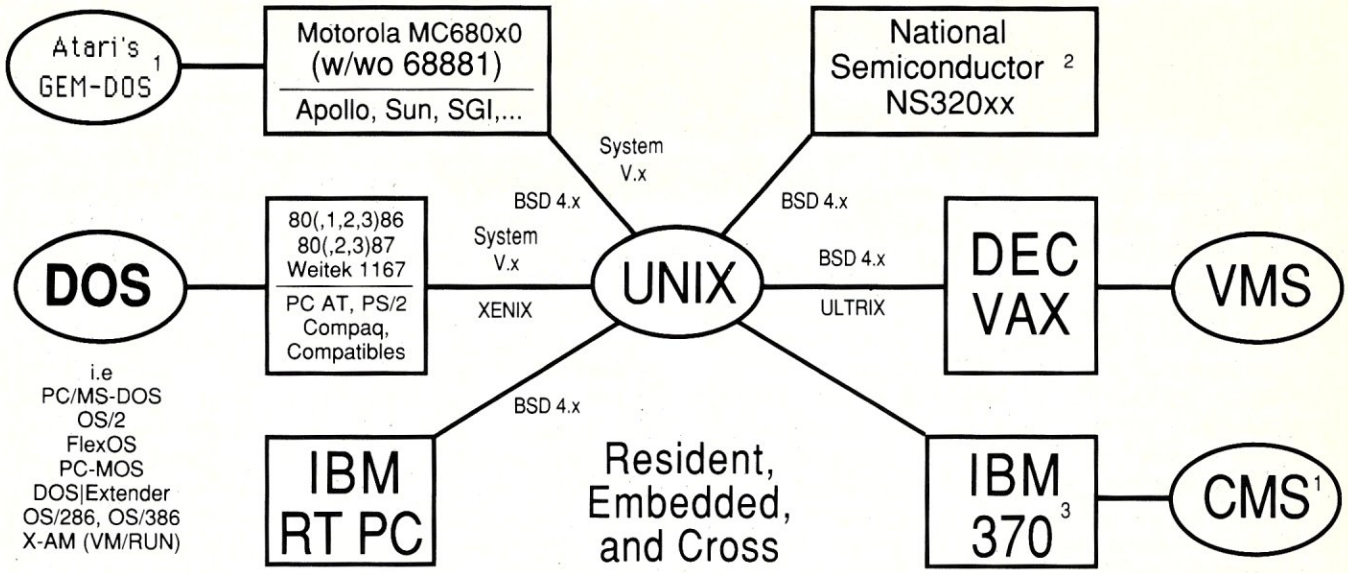
Publications of Note

IBM technical reference manuals for the PS/2 line can be ordered from: IBM Technical Directory, P.O. Box 2009, Racine, WI 53404-3336; (800) 426-7282. Prices are as follows: *PS/2 Model 30*, $75; *PS/2 Model 50/60*, $125; *PS/2 Model 80*, $125; and *PS/2 BIOS Interface*, $75.

The Boston Computer Society's PC User Group has again reviewed PC technical word processors and has published a 66-page study that compares more than 20 packages. Copies of the study are $12 (add $3 for foreign) and are available from Carl A. Hein, Dunster House, Apt. 7, Swanson Rd., Boxborough, MA 01719.

Users running MS-DOS on S-100 systems may be interested in a new newsletter entitled *PC-PRO Users' Newsletter*. Published monthly, it costs $12/year (U.S. and Canada), $24 elsewhere. Write to Terrell Dan Smith, 5825 Jefferson Ave., #3, Richmond, CA 94804. §

C and Pascal on:



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Footnotes: 1. Atari, CMS versions available 10/87. 2. NS320xx version by special order. 3. UNIX not yet available on 370.

News, Views & Gossip

by Sol Libes

Random Gossip & Rumors

From a reliable source comes word that **IBM** will license its PS/2 Micro Channel technology to certain selected competitors.

IBM and **Microsoft** are rumored to be moving on somewhat different operating system tracks that appear to be diverging. For example, IBM developed DOS, Version 3.3, without Microsoft's help and Microsoft has yet to release a compatible version. It also appears that IBM's implementation of OS/2, Versions 1.0 and 1.1, will be different from the versions Microsoft is supplying to OEMs. IBM has also announced that it will introduce a multiuser version of OS/2, whereas Microsoft has declared that it will not do so.

There are reports that **Intel** has begun shipping early 80486 processor chip set samples, with IBM an early recipient.

There are rumors that **Apple** has developed a Mac portable. **Colby Systems** (Fresno, CA), **Dynamac** (Golden, CO), and **Intelitec** (Des Moines IA) are already shipping Mac-compatible portables. No doubt Apple is waiting to see how successful these machines are before introducing its own Mac-to-go.

IBM appears to have a real winner in its new WORM (Write Once Read Mostly) drives. Word is that it originally projected sales at 4,000 a month and within the first month received orders for 40,000—10 times its projections.

IBM's price cuts and introduction of the PS/2 have caused a new round of PC/XT/AT compatible price cuts. Companies such as **AT&T, HP, Epson,** and **Zenith** have cut compatible prices from 10-30 percent. The largest prices cuts are for AT compatibles.

sales leader in Japan, but in that year **Fujitsu** overtook IBM to lead the pack. Now comes the news that in 1986 IBM dropped to third place, behind **NEC**, and has **Hitachi** breathing down its back.

IBM Finally Adopts Connectivity . . . or Does It?

On March 17 IBM announced SAA (Systems Application Architecture) and followed it with its April 2 announcement of OS/2. Long overdue, both promise a consistent portable application development environment for interconnecting IBM's micros, mini, and mainframe environments.

As these products will not be delivered for at least another year, however, many see this as a devious attempt by IBM to forestall user purchases while it tries to make its currently incompatible computer product lines compatible.

The SAA and OS/2 Extended Edition communications features are seen more as a statement of direction than a specific fact. The initial release of OS/2 will not contain these connectivity features. IBM is promising to start supplying SAA information before the year's end (for example, what networking protocols SAA will support). And also by the end of the year, IBM plans to announce when it will release details about OS/2-EE.

Many see these very early and vague announcements as a strategic defense against Digital Equipment Corp. IBM has been losing market share to DEC over the last two years. DEC has an architecture that is consistent across all its product lines and the ability to connect with IBM products. Many of IBM's key customers have turned to DEC for their connectivity needs.

SAA and OS/2-EE are not expected until late 1989 at the earliest, and application software is not expected until 1990. This is giving DEC a large window of opportunity.

OS/2 Update

IBM's new OS/2 operating system will come in three flavors: Versions 1.0 and 1.1 and the Extended Edition (see above). Version 1.0 is expected to be released early next year, with Version 1.1 to follow in late 1988. Version 1.0 will finally extend memory addressing beyond 640K and add multitasking ability. It will increase the 32-Mbyte disk limit via partitioning. Version 1.1 will contain the Presentation Manager (aka Windows). Both Versions 1.0 and 1.1 will run on current AT machines with appropriate hardware peripherals. Little is known about OS/2-EE, and it is likely that it will run only on IBM PS/2 systems.

Microsoft will be selling its own implementations of OS/2 to OEMs and is promising that its implementations will be compatible with IBM's implementations. In other words, software written to run under IBM OS/2 should also run, without modification, under Microsoft OS/2. You might encounter some different features, utilities, and user interfaces, however.

IBM gave its first public demo of OS/2 Version 1.0 at the National Computer Conference in June. The character-based version was run on a PS/2 Model 60 equipped with 7 Mbytes of RAM. The demo consisted of multitasking between a new version of IBM's Displaywrite word processor, a computer graphics demo and a spreadsheet. Viewers were impressed with the fast graphics and application switching.

Alpha copies of Version 1.0 were sent to test sites several months ago, and beta copies and software development tools were shipped in June. Version 1.1 technical specifications are expected to be released in August. IBM is expected to put copies of Version 1.0 on sale in the first quarter of next year, and we can expect to see some application software very soon after its release.

OS/2 will create problems for users and developers. Lotus, for example, has already indicated that it will release three new versions of 1-2-3—one for DOS 3.x, one for OS/2 Version 1.0, and another for Version 1.1. And, the likelihood is that when OS/2-EE appears there will be a fourth version of 1-2-3. Gone will be the days when there was only one current version of 1-2-3.

IBM is known to be developing its own Presentation Manager (PM) for OS/2 Version 1.1. Microsoft will probably rework Windows to provide compatibility with IBM's PM. IBM is also developing its own database and communications features for OS/2-EE. There is some question as to whether Microsoft will develop its own EE version to offer to OEMs.

Software developers already working with OS/2 Version 1.0 are favorably impressed with the product, reporting that it has good compatibility with DOS and provides several mainframelike features. They are impressed with features such as multithreading, multiprogramming, I/O monitors, and interprocess communications.

They report that well-behaved DOS programs can be recompiled with an OS/2-compatible compiler/subroutine library with little modification. Programs that use low-level DOS functions and access the BIOS or hardware directly require significant reworking, though. I/O drivers and terminate-and-stay-resident (TSR) programs will be the toughest to convert.

Performance reportedly suffers with OS/2. No doubt IBM and Microsoft are

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CONTENTS:

IBM's New Generation	1
What is the Strategy	1
Will the PS/2 Sell?	9
The PS/2 and Developers	9
Industry Trends and Size	1
Big Industry Advertisers	5
Translation Technology	6
The Showdown: Borland vs. Microsoft	2
Productivity Examined	3
So What Does it Mean?	8
Commercial Software Pointers	3
AI, Useful & Innovative	4
Forecast Revisited	6
New Forecasts	6
The Database Market	10
Favorite Products	10
World Class Programmers	11

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working hard to improve OS/2's performance. Reports from beta sites indicate that under OS/2 application software runs 2-30 percent slower on a PS/2 Model 60 and 2-15 percent slower on an IBM PC/AT compared to PC-DOS/MS-DOS. Integer math performance suffers the most.

Cloners React to PS/2

IBM has warned compatible makers in no uncertain terms that it will take "appropriate" action to prevent copying of patented PS/2 technology. IBM has a history of suing companies it feels infringes on its patents. It wins most cases, often putting the companies out of business.

Undaunted by IBM's threats, companies such as Chips and Technologies, Faraday Electronics, and Paradise Systems are promising chip sets that provide the non-patent-protected hardware features of the PS/2. Systems software developers such as Phoenix Technology are promising a compatible BIOS. Actually clone makers could add VGA graphics, 3½-inch disk drives, OS/2, disk and memory caching, and memory and hard-disk-size extensions to a high-speed AT. They would then have achieved the most important features of the new IBM PS/2 systems and could forego implementing the heavily patent-protected Micro Channel architecture. Clone makers could then cross out the claim "AT compatible" and replace it with "highly PS/2 compatible" without worrying about patent infringement.

In the meantime, compatible makers are taking a wait-and-see attitude. Time currently appears to be on their side as sales of XT and AT compatibles and 386 systems are currently at an all-time high. Despite IBM's claims to the contrary, initial sales of the PS/2 Model 30 do not appear to be taking the country by storm. Sales of Models 50 and 60 also appear to be nothing for IBM to brag about. Models 30 and 50 were already being discounted and available in the gray market within five weeks of their introduction. The Model 50 is being discounted by as much as $700 and the Model 30 by as much as $300. The slow summer months may see even more price erosion.

Demand for Models 50 and 60 may go up when OS/2 appears and software that exploits the PS/2's features arrives. This probably will not happen until mid 1987 at the earliest. IBM is expected to migrate many of its mainframe programs down to run under OS/2.

In the meantime, new XT and AT compatibles are being brought to market. At the recent Comdex show, more than 50 new '386 systems and accelerator boards were introduced. §

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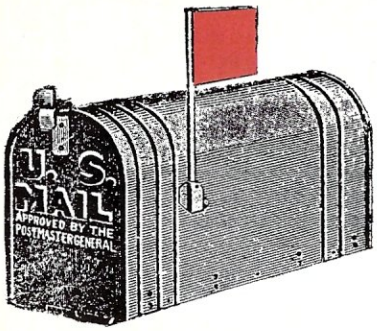

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OS-9 Question

Dear *M/SJ*,

I enjoyed your articles on multitasking, multiuser operating systems for the IBM PC and compatibles in the May/June 1987 issue.

From time to time I've come across articles about an operating system called OS-9 that is supposed to run on the Atari ST and the Commodore Amiga. It is supposed to be multitasking, multiuser, too. Do you know anything about this system? If so, how does it compare with UNIX and what other computers will it run on? Could you check this out for me, please, and report on it in the Journal?

Donald R. Adams
Kokomo, IN

Editor's Response:

OS-9 has been available for almost ten years. It is a mature and very popular disk operating system. Originally written for 6800-based microcomputers, it was later ported to many 6809- and 680x0-based systems and is offered by many system manufacturers. It does indeed provide a UNIX-like environment for these systems. It is available for a very wide variety of machines, ranging from the low-cost Radio Shack Color Computer all the way to the Gimmix multiuser system. It is my understanding that there are implementations for the Mac and even for IBM PC and Apple II machines (via coprocessor cards). I have heard nothing but good things from OS-9 users.

Formatting 360K Disks on 1.2-Mbyte AT Drives

Dear *M/SJ*,

In your article "Buying an AT Clone System" (May/June 1987) under "DISK DRIVES," you state, "You cannot format a 360K disk on the [1.2-Mbyte] drive, however." I wish to point out that you are wrong. Any decent version of the DOS FORMAT program has many switches, among them */4*, which does that which can't be done. The only problem with these disks is that they may be unreadable on marginal 40-track drives. Such disks should not be subsequently written to on 40-track drives—they should be used only for downward migration of programs and data (1.2 Mbytes to 360K). I have done this often without a single failure. If your 360K drive can't read a disk formatted on an HD drive, perhaps it is time to take it in for a tune-up.

Welbrey A. Hill

Asking questions and getting responses in MS-DOS batch file modes

Dear *M/SJ*,

In the May/June 1987 issue of *M/SJ*, Bill Rogers wrote about his program qryrsp.c, which acts on responses during the execution of batch files. Not being an expert C programmer, I have three questions:

1. What is the purpose of the line:

```
static char SCCSID[]=
 "@(#)qryrsp.c 5.0.2"
```

I suspect it serves as an identifier for the program within the code. Is it used for anything else?

2. Why does Mr. Rogers use the statement:

```
C = fgetc(CONSHNDL)
```

as opposed to *C = getch( )* to read the responses from the buffer?

When using his statement, a carriage return must follow the response before qryrsp.c continues. Using *getch( )* works without the carriage return. It appears that a file handle (CONSHNDL) is being used rather than accessing input directly to assure portability across different machines and/or compilers. Please note that I compiled the program using Microsoft C, Version 4.0, after changing the code to use *getch( )* and removing all statements regarding *CONSHNDL*. It has worked successfully on an IBM PC using DOS 3.1.

3. What is the purpose of the line:

```
static string FUNC[] = "main";
```

I hope to see other good programs from Mr. Rogers in the future.

George E. Carter, Jr.
Baltimore, MD

Author's Response:

Often one would like to know the version of an .OBJ file or the versions of the modules making up a .EXE file. Many systems have a command, often called what, *that searches a file for* @(#) *(the usual UNIX sequence), or some other character sequence, and then displays the module name and version number.*

The console file used in the program is opened in "raw" mode (no echo, no special cr-lf handling, no buffering). My compiler did not have the function getch *that you used. Incidentally,* getch *is not part of the proposed standard C library.*

The constant:

```
static string FUNC[] = "main";
```

is used by my debugger, and I overlooked deleting it when I removed the debugging code from this file. Incidentally, an article describing this debugger will appear soon in M/SJ.

Bill Rogers §

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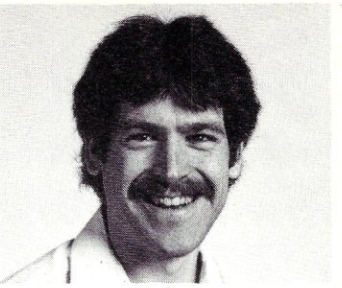

Double Trouble

This column features tips and techniques for using the C language productively. It discusses typical problems with using C and their solutions. Reader suggestions, comments, and questions are encouraged. Address them to "The C Forum," Micro/Systems Journal, *Box 1192, Mountainside, NJ 07092.*

C doesn't score too highly as a language for numerical programming. Indeed, the number of pitfalls when using reals (that is, floats and doubles) is large. I will discuss the common ones in this column. Perhaps you can avoid repeating the same mistakes I made.

C's approach to real numbers is not unlike its approach to everything else. You get access to the machine-dependent floating type but very little help beyond that. Making assumptions that C floating point protects you from the reality of hardware is a mistake. For example, the following fragment shows a classic problem:

```
float f = 0;

while (f != 1) f += 0.1;
```

How many times will the loop execute? No, not 10. It will be many more, and it may not stop at all. Briefly, the problem is that 0.1 is not directly representable in binary. A small error occurs on each addition that is enough to make the termination condition fail on the 11th test.

Critics have suggested that we ban the use of = = (and !=) with floating-point operands. This is a bit like removing *goto* from a language, though. If you find yourself using it, you are probably doing something wrong, although on rare occasions it is appropriate.

The point is that use of = = with floating-point operands is usually a mistake. Many floating-point operations truncate or round results. Some classes of numbers (for example, irrationals) cannot be stored precisely, no matter how many bits of mantissa (after the decimal point) you have. Perhaps the only time that you should use = = is for testing against 0 (to prevent division by 0, for example) or other constants that appear at discontinuities or undefined domains in functions.

A particularly nasty problem is that a computed result in a register and the same value stored in memory and returned to a register may fail a comparison for equality—for example:

```
c = a/b;
if (c != a/b)
  printf("I'm shocked\n");
```

This occurs in machines that have guard bits. These are extra bits at the ends of registers that are used to increase precision in calculations. As well as being used in computations, guard bits can also be used to round values when they are stored in memory.

An amusing anecdote is related by Kernighan and Plauger in *The Elements of Programming Style*, page 95. They note that the version of FORTRAN at their local installation fails on an equality test when one number is on an input punch card and the other, identically typed and also a constant, is in a program. This is because different scanning routines were used in the I/O library compiled with the FORTRAN program and the I/O routines that were part of the compiler!

There are ways around these problems. One is symbolic programming using an arbitrary-precision subroutine (check the C User's Group Library for several in the public domain). A much easier approach for C programmers, however, is simply to leave room for the error. This is often called *fuzz*. Thus, you can rewrite *while (x != y)* as:

```
float fuzz = .0005;

while (x < y - fuzz)
```

Choosing the value of *fuzz* can be extremely critical, of course, and it depends entirely on the operations and numbers involved.

Some languages, such as APL, have a fuzz variable built into all comparisons. Other languages, such as Forth, take the opposite view—floating point is not provided at all, in the belief that it is never necessary anyway. And in the rare case that it is, you are probably better off representing reals as numerators and denominators and keeping track by hand.

When writing operating systems or device drivers, this makes a lot of sense, but C is now used for many higher-level applications in which floating-point numbers are a necessity.

Mistakes in Cement

Apart from the understandable problems discussed above, history has left us with some curios in the C language with regard to reals. All of these are part of the C language, as defined by K & R:

1a. Automatic promotion from float to double in expressions. Although this has the benefit of decreasing the size of math libraries, it is often a drawback. In particular, some applications do not require double precision and would run much faster if all computations were performed in single precision. Some C compilers allow the programmer to turn off this particular automatic promotion.

Historically, this behavior is due to the PDP-11 not being able to query the FPP (floating-point processor) about whether it was in single- or double-precision mode. Because double-precision arithmetic was not much slower than single, it was decided that all arithmetic would be done in double precision and the kernel could assume that all processes ran in double-precision mode, making for very fast context switches.

1b. Automatic promotion from float to double in function calls. If you pass a

Microsoft Avoids Challenge

We challenged Microsoft to a C compiler duel-to-the-finish, comparing compile, link and execution times, and we offered to stop advertising for two months if they won...

by Roy Sherrill, President, Datalight

Microsoft purchased our C-compiler during February 1987 and we still haven't heard from them. OK, Microsoft, we are extending our challenge deadline from April 1, 1987 to May 15, 1987. After all, the Microsoft ad claims "the fastest C you've ever seen." Your reply, Microsoft!

Walter says Optimum-C is better

Walter Bright, the developer of Optimum C, says that Optimum C would win 7 out of 10 benchmarks as compared to Microsoft C, V.4.0. Walter explained to me that Optimum C includes a unique global optimizer that helps create compact code while increasing execution speed up to 30%. By the way, Borland, Walter is still waiting for his copy of Turbo C® V.1.0. Borland's ad claims "the fastest, most efficient and easy-to-use C compiler at any price."

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The benchmark suite will consist of the set of programs that Microsoft supplied to *Computer Language* for their February 1987 C compiler review issue. Microsoft will make available the programs to Datalight at least two weeks prior to the benchmarking. The benchmarking will be between Microsoft C 4.0 and Optimum-C. It will occur at a mutually agreed upon time and place. Interested individuals will be allowed to attend. The benchmarks will be compiled and run on a standard IBM PC-AT.

There will be two separate tests for each program: compile and link speed, and execution speed. For each test, a representative from each company will set up the compiler so that it performs at its best.

The benchmarks will be adjusted so that they take sufficiently long to run, that the tolerance involved in timing them is insignificant. The winner is determined by the compiler with the faster execution times for the majority of the benchmarks. We'd like an answer from Microsoft no later than May 15, 1987.

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float as an argument, it will automatically be converted to a double. Similarly, a float parameter will be compiled as a double, although it will be converted back to float (and converted back to double!) before being used in an expression. Depending upon the subtleties of these implicit conversions is probably a mistake as some compilers do not follow them completely. Just don't specify floats as formal arguments.

2. Remainder (%) doesn't work for floats or doubles. This is an odd restriction as division is allowed on reals. The obvious implementation is as follows:

```
#define remainder(x,y)\
   (x - y*floor(x/y))
```

where *floor(x)* returns the largest integer not greater than x.

Although some machines produce a remainder as the result of a division, it is often not mathematically usable. This is unfortunate, as when using a remainder, the likelihood of also using the quotient is quite high.

An optimizing compiler will reuse the results of the computation x/y if it occurs again in the same block, but the designers of C were short-sighted in forcing the programmer to have to write the expression twice rather than completing the implementation of %.

3a. Floating-point operations can be reordered automatically. Parentheses do not play the same role in C that they do in FORTRAN. In particular, according to K & R, page 185: "... the compiler considers itself free to compute subexpressions in the order it believes most efficient.... Expressions involving a commutative and associate operator (*, +, &, |, ^) may be rearranged arbitrarily, even in the presence of parentheses; to force a particular order of evaluation an explicit temporary must be used." Thus a C expression such as $(x + y) + z$ can be computed by first adding together x and y, or y and z, or x and z!

The reason for this is that the compiler might already have the values of x and z (but not y) in registers. Following the order suggested by the parentheses might require an extra load and save of a register. More complex examples are even worse. This behaviour can be very important in a piece of code that is repeated frequently. It is easy to come up with examples in which a particular evaluation order is critical, however. On a 68020 (8-byte doubles), for example, if $x = = 1E8$, $y = = -1E8$, and $z = = 1$, then adding x and y first gives the result 1 (correct) whereas adding x and z first gives the result 0 (incorrect).

If you really want $x + y$ to be evaluated first, you must write:

```
temp = x + y;
. . . = temp + z;
```

This is rather clumsy, and in ANSI C, this is expressible as $+(x + y) + z$, where the $+( )$ construct explicitly forces the evaluation of $x + y$. Yes, it's ugly. The syntax is already supported in many compilers, however, and has the same effect simply because unary + is of higher precedence than the other arithmetic binary operators.

Depending upon the values, evaluation order can certainly cause problems. For example, $x + z$ may both be close to the largest number that can be stored in a double. If y is a very negative number, you might be depending upon $x + y$ to be computed first whereas $x + z$ might cause an overflow. Overflows and underflows usually expose themselves quickly and during initial testing because the results are complete garbage.

A more subtle error due to the same reordering behavior is the loss of significant digits. Again, the order of evaluation is very critical to the precision of the result, but the results of this are less likely to be noticed during initial testing because the results may still be accurate in the most significant digits but completely incorrect nonetheless. This type of problem is specific only to floating-point calculations because integral types cannot lose precision in computations except by overflow and underflow, as noted earlier.

Mathematically speaking, reordering of expressions in this way is perfectly valid (because there is no concept of overflow or underflow in mathematics). It is only the realization of mathematics on a computer that has added these notions. Notably, FORTRAN gave many people the idea that parentheses indicate order of evaluation. Remember that this is only true in FORTRAN—not mathematics (where it doesn't matter) and not C (where it does).

3b. Overflows and underflows cause undefined behavior in C, except in special cases that I shall not discuss here. In some cases, the result is simply computation of an incorrect value. In others, a machine fault occurs (such as when dividing by 0).

The most important cases in the context of this discussion are those in which the true mathematical result of an operation cannot be represented as a value of the expected result type. These are semantically valid but implementationally flawed.

I am told that the reason why overflow and underflow in floating-point calculations were not reported was that there was no way to reset the FPP on the PDP-11 if the error occurred immediately before a context swap. Hence, the error could be reported to a different user.

Summary

Working with floats and doubles is fraught with danger, not only from the realities of computer realizations of abstract concepts but also from historical quirks in the C language that we have all learned to live with.

An understanding of some of the weak spots of C and its support (or lack of it) for real numbers is essential for doing numerical programming in C. Furthermore, a good course in numerical methods is very helpful in understanding how to reduce loss of significant digits, designing algorithms that produce meaningful results, and so on. Sometimes it is fun to learn by experience, but this is one area in which the difficulties are extremely subtle and understanding them takes perseverance (and maybe the choice of another language)! §

Don Libes is a computer scientist working in the Washington, D.C. area. He works on artifical intelligence in robot control systems.

Further Readings

IEEE Standard for Binary Floating-Point Arithmetic. ANSI/IEEE Std 754-1985. New York: IEEE, 1985.

Knuth, Don. *Seminumerical Methods*, Volume 2, and *The Art of Computer Programming*, Volume 2. Reading, Mass.: Addison-Wesley, 1981.

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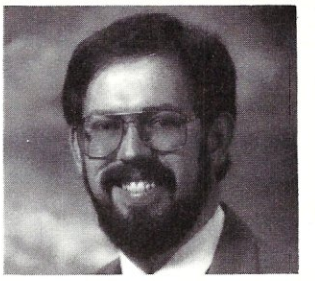

Reviews of Some New Turbo Pascal Support Software

This column features tips and techniques for using Turbo Pascal productively on MS-DOS/PC-DOS and CP/M microcomputer systems. It discusses typical problems and their solutions. Reader suggestions, comments, and questions are encouraged. Address them to Turbo Pascal Corner, Route 5, Box 107K, Greenville, TX 75401 or through MCI mail, 289-6124.

One of the perks associated with writing this column is that I get to see a lot of Turbo Pascal support software, some good and some bad. So far, I have reported on one of these packages in each column. Lately, the rate at which new products have been appearing on my doorstep has been exceeding the rate at which I can review them here. Bad products I don't mind overlooking, but my review box is beginning to reach the critical stage at which a lot of good products are getting dumped on the floor. To address this problem and to reduce some of the backlog, I am devoting this entire column to new Turbo Pascal support products.

Before I do, however, I want to make a few comments about Borland's other languages. First, Turbo BASIC has been shipping for a while now and the consensus is positive. I am no BASIC afficionado, but my friends who are tell me that Turbo BASIC is impressive—fast compilations and good performance. Of course, Microsoft's QuickBASIC 3, which began shipping not long after Turbo BASIC, is a worthy contender. I don't know which is better or if you can even make such a simplistic judgment, but either way it's the programmer who ends up the winner.

Second, Turbo C has been appearing in ads since late January, although it's still not shipping as of this writing. Hopefully, it'll be on the shelves by the time you read this. I have had a beta version of Turbo C for some time now, and I am very impressed with it. It's all that Borland's advertising makes it out to be. If you are a C buff, this is the compiler you have been waiting for—C combined with the now famous Borland interface (I know, Let's C had that a year ago, but this is as good as any C I have seen). Here again, Microsoft C might have given Turbo C a run for its money were it not for a roughly 4:1 price ratio, assuming the standard mail-order discount.

I understand that Borland has a whole raft of toolboxes waiting in the wings. (Toolboxes are collections of software that programmers can include in their programs and claim as their own without paying royalties.) When we will get to look at these, I do not know, but you can be assured that they will be reviewed in this column as soon as they are out. For now, let's look at some PC Turbo Pascal support products from other companies.

TurboWindow

TurboWindow is the Turbo Pascal version of MetaWindow from Metagraphics Software Corp. Versions of MetaWindow for other languages exist, including an OEM version that can be directly linked into the user's program. TurboWindow is a RAM-resident program and must be loaded before entering Turbo Pascal. Once loaded, TurboWindow provides the functional equivalent of the famous Macintosh ROM routines.

Most of the facilities provided by TurboWindow are graphical in nature—opening and closing windows on the screen with automatic scaling and clipping, moving a customized cursor around on the screen, drawing various shapes, and so on. Routines are also included to interface with the mouse. One of the nicer features of this package is that it supports just about every known graphics adapter in the free world. Unlike Borland's toolboxes, TurboWindow decides on an adapter at run time and not at compile time, which is a distinct advantage for those writing commercial packages that are likely to see numerous different types of displays.

This appears to be a powerful package. It is definitely worth looking into for anyone comtemplating developing a Turbo Pascal program with a highly graphical output, especially if it has an object-oriented (icon-oriented) interface. The documentation does not make the licensing arrangement clear (that is, it does not say "no royalties required" anywhere in the text), so that may be a factor to investigate. It must be possible, however, because I know of at least one commercial program based on the TurboWindow interface.

TurboPower Utilities

Also referred to as The Programmer's Utilities, this package comes from TurboPower Software, maker of that wonderful source code debugger for Turbo Pascal, T-Debug Plus. The utilities are actually nine stand-alone programs that can be run from the DOS prompt. Some of these utilities are specifically Turbo-related, whereas others are more general in nature. Some of the more general functions are also available in the public domain. All can be purchased with source code with which users are free to experiment.

The general routines include improved directory commands—*SDIR* and *ROOT*. *SDIR* is a much improved version of DOS' *DIR* command. *ROOT* can find a file anywhere in a hierarchy of subdirectories, which can be a real problem on a hard-disk system. UNIX-like pattern-recognition routines are also present, such as a difference finder and a pattern-recognition and replace facility. Finally, a command repeater is included for pulling up and executing previously entered DOS commands without reentering them.

The Pascal-specific routines are the

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most interesting to me. Besides the normal pretty-printer for generating properly indexed Pascal listings, the utilities include a program structure analyzer, an execution timer, and an execution profiler. The structure analyzer can look for potential problems, such as "dead code," which cannot be reached. Both of the latter timing utilities speed up the system clock to achieve timing accuracies of roughly 200 μsec (200 millionths of a second). The execution profiler shows you graphically where your program is spending the most time, a critical piece of knowledge when trying to speed up existing programs.

The Programmer's Utilities is a nice, if not exactly overpowering, set of Pascal utilities. The source code, although well written, has not been designed to be adapted into others' programs. If you are serious about Turbo Pascal, however, I recommend it.

Turbo Extender

Another package offered by TurboPower Software is Turbo Extender. This is a utility that addresses Turbo Pascal's 64K code and data segment limitations. Under Turbo Pascal, the size of your program is limited because the resulting .COM file cannot exceed 64K in length and by the same token neither can your program's data area.

Turbo Extender includes two utilities—BIGTURBO and BIGARRAY—which your program can use to help it over the 64K hurdle. With BIGTURBO, you break your program up into several modules that actually get compiled separately and are then linked by BIGTURBO. BIGTURBO can leave the files separate or can combine them into one large .EXE file. BIGARRAY allows one- and two-dimensional arrays to use simple RAM, extended EMS RAM, or even disk to build virtual arrays of almost any size. Of course, such arrays are a little slower to access, especially those on disk.

Other interesting utilities include a disk cacher that programmers can easily build directly into a Turbo Pascal program. Disk caching is a technique that involves using a small amount of RAM to save most-often-used disk sectors to increase disk throughput. A large cache results in almost RAM-disk speeds but with everything safely on hard disk in case of power failure.

For those to whom 64K feels like a one-room apartment, this may be the answer you need to move your Pascal programs into a 640K "normal RAM" house or even an 8-Mbyte EMS mansion.

Turbo Pascal Corner

Listing 1—BASIC Sieve

```
100 DEFINT A-Z
110 LIM = 8190
120 DIM FLAGS(8191)
130 PRINT TIME$
140 FOR I=0 TO LIM
150   FLAGS(I) = -1
160 NEXT I
170 PRINT TIME$
180 FOR I=0 TO LIM
190   IF FLAGS(I) = 0 THEN 270
200   PRIME = I+I+3
210   K = I+PRIME
220   WHILE K <= LIM
230     FLAGS(K) = 0
240     K = K + PRIME
250   WEND
260   COUNT = COUNT + 1
270 NEXT I
280 PRINT COUNT; "PRIMES"
290 PRINT TIME$
```

Listing 2—Turbo Pascal output by Bas2Pas from BASIC Sieve

```
PROGRAM sieve(Input, Output);
CONST
  max_string_length = 255 ;
TYPE
  Single = Real ;
  Double = Real ;
  Basicstring = String[ max_string_length ];


{$I graph.p}
{$I general}

PROCEDURE sub110; FORWARD;

PROCEDURE sub110;
VAR
  count           : Integer ;
  flags           : Array[ 0 .. 8191 ] OF Integer ;
  i               : Integer ;
  k               : Integer ;
  lim             : Integer ;
  prime           : Integer ;

BEGIN     { sub110  }
  lim :=  8190;
  Writeln(time_str);
  FOR i := 0  TO  lim DO
    BEGIN
      flags[  i ] :=    - 1 ;
    END;
    ;
  { FOR }
  Writeln(time_str);
  FOR i := 0  TO  lim DO
    BEGIN

      IF  ( Not  (  flags[  i ] = 0 ))
        THEN
          BEGIN
            prime :=    i + i + 3 ;
            k :=    i + prime ;
            WHILE ( (   k <=  lim ) <> 0 ) DO
              BEGIN
                flags[  k ] :=  0;
                k :=    k + prime ;
              END;
              ;
            { WHILE }
            count :=    count + 1 ;
          END;
      { IF }

    END;
    ;
  { FOR }
  Writeln(count,  'PRIMES');
  Writeln(time_str);
  halt  { BASIC END };
END;      { sub110  }

BEGIN         { main program : sieve }
  sub110;
END.          { main program : sieve }
```

Bas2Pas

This strange-sounding utility from GoToLess Conversions, an even stranger-sounding company, is a BASIC-to-Pascal program compiler. Bas2Pas is designed for those programmers making the transition from BASIC to Turbo Pascal and wanting to bring their existing code with them. It takes a BASIC program as input and generates either an ISO Pascal or Turbo Pascal program as output.

The most recent version of Bas2Pas comes on seven floppies. Although it is possible to run the package from a floppy-disk drive, I wouldn't want to do it more than once. Contained on those floppies is a multipass converter. Some of the passes analyze the input BASIC program for structure and variables, some optimize the program for conversion, later passes generate Pascal output, and a final pass optimizes that. Speed of conversion, although not terrible, is really not a factor because this isn't the kind of thing you need to do all the time.

How well does Bas2Pas work? I am amazed that it works at all, let alone how well. GoToLess Conversions offers numerous examples of programs that converted into well-written Pascal with nary a complaint, but I had a lot of trouble getting a BASIC program converted into totally error-free Turbo Pascal—invariably an error or two would creep in. None of these errors was too difficult to rectify with a small amount of editing, though.

GoToLess Conversions needs to do a lot of work on the manual. Once this is cleared up, though, I believe this utility can be a real aid—but not the complete answer—for converting existing BASIC programs to Turbo Pascal. You don't have to take my word on this completely. An example conversion of the famous Sieve of Eratosthenese appears as Listing 1. If you're still interested, send a reasonable-size example BASIC program to GoToLess with $5 plus an SASE and the company will run it through the converter and send you the results for evaluation. You should also ask for pricing at that time because it is complicated and changing at the moment. §

Stephen Randy Davis is a senior systems programmer for a defense contractor in Greenville, Texas, where he programs various microprocessors. He is also working on his Masters in physics.

Product Information

TurboWindow for Pascal
TurboWindow for Pascal, $95
Metagraphics Software Corp.
4575 Scotts Valley Dr.
P.O. Box 66779
Scotts Valley, CA 95066
(408) 438-1550

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Turbo Extender, $85
TurboPower Software
3109 Scotts Valley Dr., Ste. 122
Scotts Valley, CA 95066
(408) 438-8608

Bas2Pas
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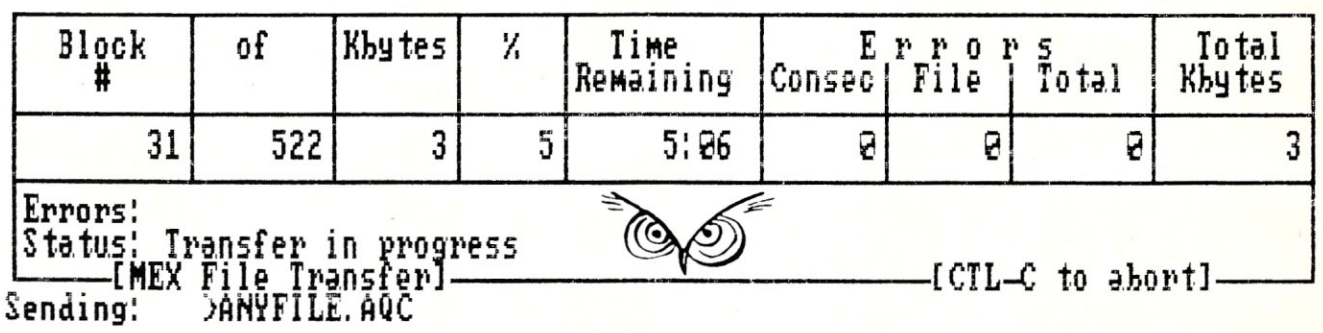

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Setting Up a Networking, Multiuser, Bulletin-Board System

by Stephen M. Leon

If anyone ever tells you that running a BBS is a snap, you can be assured they have never run one. If the system is not constantly busy, you wonder what you did wrong. If the system is always busy, you complain about not being able to use it for updating and maintenance.

You fret about Trojans and disk crashes and bad phone lines and jokers who sign on as Jack Theripper. Once the system is up and running, however, you discover that, although it is a lot of work, it has its rewards. You find that people appreciate your efforts to have a good board, and so you continue, functioning essentially as an individual public utility.

Setting Up a Single-User BBS

When I first set up by BBS system, I used a 4.77-MHz XT clone with two 20-Mbyte hard disks. For software, I chose Tom Mack's RBBS-PC software. Aside from being free, readily available, and a terrific piece of software, I knew someone who was already running it, so I had a place to go for help. With a standard modem and a standard IBM PC, or true clone, getting it up and running required nothing more than running a simple configuration program and getting a few tips from my friend.

RBBS-PC comes with 130 pages of documentation. It is written primarily in BASIC and can be compiled with Microsoft's QuickBASIC. It also comes with source code, so you can do your own modifications and recompiles, assuming you have the need and the skills. I bought a copy of QuickBASIC but was never able to figure out how to make changes in the program. At last count, Tom has released 27 versions of RBBS-PC since the original release dated July 4, 1983. For new BBS operators, RBBS-PC is an excellent starting point.

You can download a copy of the latest version of RBBS-PC (15.1 B) from almost any RBBS system. The PC/Blue library (volumes 345-347) has it, or you can get it directly from the Capital PC Users' Group.

As your BBS gets more and more calls, you review your options. By now you discover that just about every modem manufacturer has a sysop deal, and chances are you opt for a pair of genuine Hayes Smartmodems directly from Hayes at $375 each. But, as the calls build up, you realize that you need a second line!

Going Multiuser

One of the many nice things that can be said about RBBS-PC is that it is small. On a 640K PC you can run two copies of the 14.1 D version. To run 15.1 B you will need either a RAMPAGE card or will have to trim a little code. If you are using an 8-MHz XT clone, an AT&T 6300, an 8-MHz AT, or some other speedy IBM PC type, Quarterdeck's DESQview will allow you to run two complete BBS systems on one computer. I purchased an 8-MHz clone replacement motherboard and a copy of DESQview 1.2 and proceeded to go multiline.

The setup is relatively simple. Create a subdirectory for BBS 1 and another one for BBS 2. Set up your AUTOEXEC file to go to your DESQview subdirectory and start DESQview. DESQview allows you to start up with a script that first loads BBS 1 and then loads BBS 2. It gives you a split screen with one half for each BBS. You can zoom in on either half and make it a full screen should you want to CHAT or take a closer look.

You need only one copy of RBBS-PC on the system, although you do load it twice. Make sure your path is set properly. The only files not shared are the CALLERS file, the COMMENTS file, and MENU0 (the sysop menu). These three files are placed in both subdirectories. To set up the system, you run the RBBS-PC configuration program in each of the subdirectories as a single-user system. This creates a separate RBBS.DEF file in each subdirectory. Both configuration files can be identical, or you

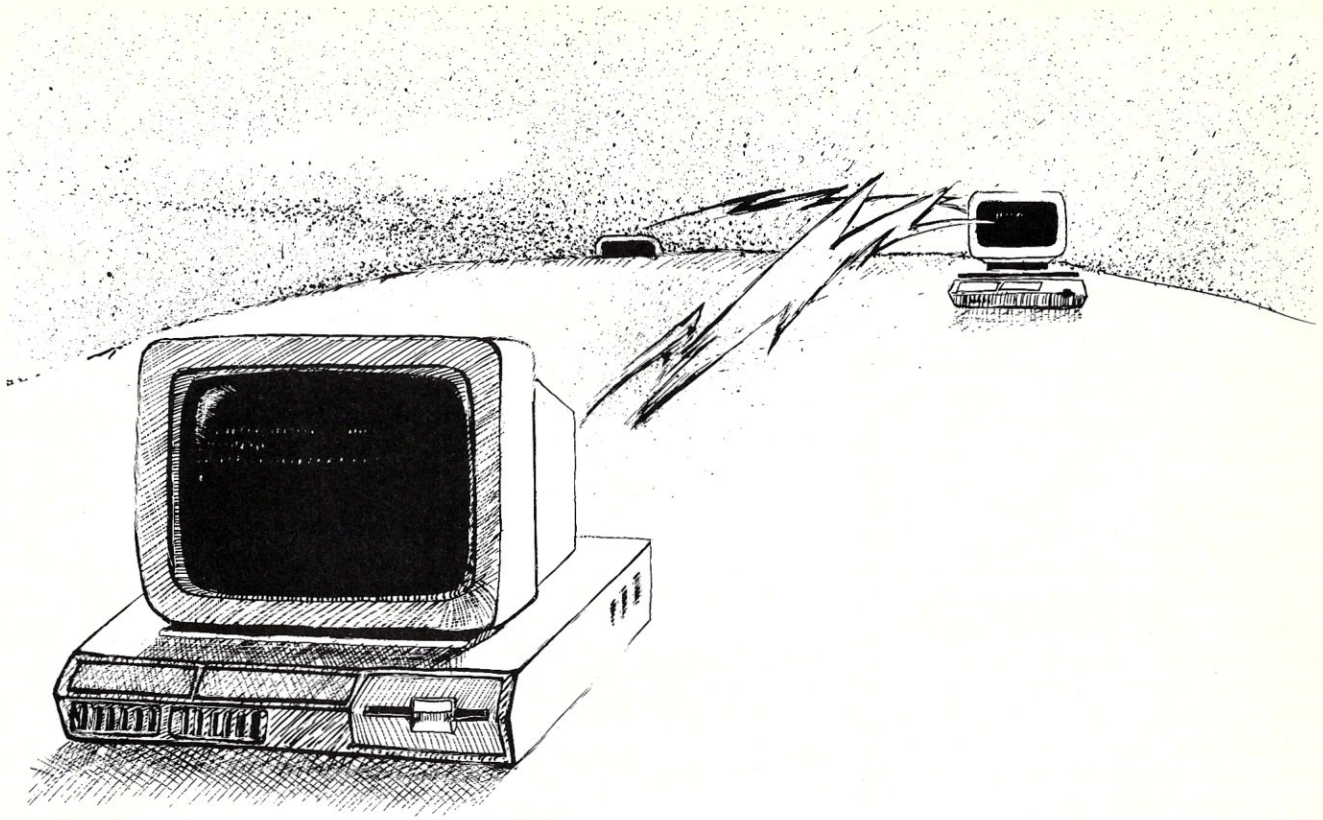

ILLUSTRATION BY JOHN PARK

can set different user options (such as restricting 300-baud callers on one board). To review your BBS activity, you have to review the CALLERS and COMMENTS files separately for each BBS.

The DESQview parameters are relatively simple. For a turbo PC, set your time slice to 3 foreground and 3 background. For an AT, use 1 and 1. For an AT&T 6300, time slice at 2 and 2. If you are trying to run two systems on a 4.77-MHz PC, forget it!

I allocated 195K to each RBBS-PC window, although it can work in only 168K. If you upgrade to 15.1 B you will need 256K for each window. The EEMS card will allow this without any problems. Other DESQview parameters are closed on exit to DOS, display graphics information, use own colors, and allow keyboard and script type-ahead. All other options should be off. If you set your memory to 165K and have no memory-resident programs, with any DOS other than 3.2, you should be able to run a small editor in a third window. You can even work on files while two callers are on-line. If you are going to run a third window, make sure you set up the two BBS windows for half-height horizontal.

A big advantage of using of DESQview in batch-file mode is that on a loss of power the whole BBS just restarts itself. When the machine was left alone during vacations, I used a heavy-duty appliance timer from Sears to shut it down in the middle of the night and then restart it shortly after. That way, if the system went down during the day, it would start up again that evening automatically. Unfortunately, DESQview trips you up often enough to require close monitoring. For example, if there is a disk read error, DESQview obligingly asks if you want to abort, retry, or ignore. In so doing, it hangs up both boards as that message goes to the system screen—not to the user. Other people have used different multitasking software, such as Double DOS, with good results. I suspect that the ultimate scenario with those systems would wind up essentially as it worked out in my case.

Creating a Networking BBS

RBBS-PC is a great starting point, but there comes a time when you know the system has to grow and you start to question whether RBBS-PC is still for you. By now you have increased your storage capacity with a high-capacity disk and an RLL controller, and you feel that the 8-MHz clone is running about as hard as it can. As good as DESQview is, the time slice is never perfect for the operation at any given moment. The system usually hangs at least once a week and has to be watched constantly. Moreover, the modem recycling on RBBS-PC hangs up the machine at least every other week. By now, you have also noticed that on occasion a caller will "piggyback" when the last caller hangs up. You have disabled the doors on RBBS-PC because of this danger, but that means you cannot work on the system from a remote location. Besides that, RBBS-PC is on the slow side. So what do you do?

The next step up for the system logically is some kind of network or slave board. Now we are starting to talk real money. But, you have to make the choice—stop growth or spend more cash.

I had two XT turbo clones that I could use for the system and an AT clone that I could use as a server. I made the decision—I was going network—if the price was right!

I chanced upon a good buy at a flea market and picked up three IBM PC Network cards, a translator unit, software, and cable for about $500. An equally attractive choice would have been PC Office cards. Slave cards and multilink cards are an acceptable alternative if you can get them at a good price. A 640K turbo clone with one drive and a flea-market network card should cost less and be more practical

than any slave or multilink card, however.

Now that the BBS was going network, the big question was what to do about software? RBBS-PC worked on the network, but it seemed that it was time to look around for a possible replacement. The best way to find out what is around and what you like is to call a variety of different systems and check out their software. I did just that.

Considering the time and money already invested in the system, I did not limit my search to noncommercial packages. In fact, I ultimately concluded that a switch to a commercial package was advantageous when I went into a network situation. Let's face facts—first-time installation of a network and network software is not a simple matter. I knew it would take a lot of hardholding to get the thing working.

Every network has different setup problems. There is no way that Tom Mack and the Capital PC Users' Group can give the kind of individual support needed to get a network BBS system functioning with some dispatch. Had I known another RBBS-PC operator running on the network I bought, I might have leaned on that sysop for help. I didn't know anyone, so I decided to opt for a supported commercial package.

RBBS-PC has a nice look and feel. In looking for a possible replacement, I naturally turned to software that not only resembled it but that also added to it. Two widely used commercial software packages—PCBoard from Clark Development Co. and dBBS from Dan Doman—seemed to fit the bill.

Both packages checked out as acceptable alternatives. I then made an analysis of their respective strengths and weaknesses. Of the two, I chose dBBS as the better package for my system. Dan Doman's dBBS provides software to convert RBBS-PC (or other BBS) user and message bases to the new software. PC Board's conversion requires that you either write the software or manually reenter the data. DBBS is therefore an easier convert from RBBS-PC.

The next factor was language. PCBoard, like RBBS-PC, is compiled BASIC with some assembly language. DBBS is written in C and assembly language. From my calls to systems using these two programs, dBBS seemed to operate faster. DBBS uses Btrieve (see *Micro/Systems Journal*, January/February 1987, page 58) to find user data, and its searching seems much faster.

I found the command chaining superior in dBBS. I also liked its support for YMODEM BATCH mode, which I think is the best way to download files. I was pleased with the substantial number of companies and individuals who were using dBBS on a variety of networks and was amazed that everyone I spoke to had nothing but praise for Dan and his software. Finally, Dan Doman was on the East Coast—a lot closer than Fred Clark in Murray, Utah.

I called Dan Doman and arranged to pick up a copy of dBBS. Inside of an hour after arriving home with the package, it was running in test mode as a single-user system. No documentation is ever good enough, but the 54 pages of documentation that came with the single-user system were more than adequate to do the data-file conversions and get the system up and running with ease.

Unlike RBBS-PC, which is configured via software, in dBBS you merely modify a series of files to set your system param-

Listing 1—DBBS-DEF.DEF, the main file of dBBS

```
**** you can separate each field with the same delimiters
**** that you can use in the command chain
**** e.g.. ;/!@#%&,
**** start of def file ****
*** fore, back, border, port, baud, defpage, display (0=mono 1=color) ***
*** last item is pin22 (boolian), false means get ring as result
*** code from the modem, and not use the preferred method from pin22
7 1 4 1 2400 23 0 1
******
**** modem initialization
ATZ|!!!!!!ATE1 V1 X1 M0|!!!
**** modem answer
ATA|
**** modem busy
ATH1 M0|
****
**** answer on ringnum just like Hayes ATS0=x where ringnum means answer
**** AFTER x rings
0
*** systemname
THE CLIFFSIDE PARK dBBS SYSTEM
*** sysopname
Steve Leon
**** params for timed event
**** if event_time=0, there is NO scheduled event
**** event_time in mins from midnight, MinTime_To_Login, Min_time_To_Upload
0   5 30
***  systempassword minimum-space-for-upload, slowbaud discussed on next line
*** slowbaud=1 -> no NEW 300 baud callers,slowbaud=2 means NO 300 baud
                                                        callers at ALL
sml 50000 0
*** PRINTer (boolian) sysavail path for
*** parameter files,startup user paramater file  ***
*** login-commandfile, leave blank for default  commands ***
0 0 d:\dbbs users  d:\dbbs\start.1st
*** welcome prelog logfile confmenu newusers ***
i:\welcome i:\prelog d:\dbbs\logfile d:\dbbs\confenc d:\dbbs\newuser
*** shelldos - exit to DOS batch file
d:\dbbs\cb-dos.bat
*** stalltime master-directory directory-ext upload-dir
250 dir dir 99
*** post-security postfilename
50 d:\dbbs\postfile
*** upload credits
*** credit for regular uploads, credit for lib/arc uploads
1 2
*** other security levels *****
***xpert filemenu  utilitymenu
4 4 4
**enter-mess kill-mess(command) scan-mess read-mess namescan
4 4 4 4 5
*** page resettime listfile scanfile
4 10 4 4
*** newfiles exittodos reset-system overwritefile
0 50 150 100
*** standard-online-time newuser-security ok-tosecure-mess
*** security to add a ser to a conference
92 5 5 99
*** THIS LINE IS OPTIONAL
*** neverup ->list of names never to be uploaded
d:\dbbs\NEVERUP
```

Listing 2—DBBS' main system USERS.DAT file

```
*** admit, sysopmenu, modify user, sysoplevel, sysopmail, modify messages
4 10 10 10 10 10
*** download,upload,killall messages,notkill public,notkillany
4 4 11 50 110
*** killthread flag user does not have to kill threaded messages
*** regardless of other security values BOOLIAN e.g.. 1 or 0
0
**** name (and path) of menu tag file, name (and path) of help tag file
i:\menu i:\help
**** name of database `trio', name of questionnaire
d:\dbbs\users question.def
**** name of `.DL' file (download paths), name of 'upthreat' text file
d:\dbbs\USERS.DL upthreat
```

eters. The main file dBBS-DEF.DEF is shown in Listing 1. The documentation fully explains each item, but as you can see, it is as easy as can be to configure. In addition, each conference and the main system have a .DAT file that defines the conditions of use and entry.

Conferences can have their own bulletins, questionnaires, and files for downloading. Listing 2 shows the main system USERS.DAT file. The conference .DAT files are essentially identical.

DBBS allows you to have different start-up routes for different security levels. New users can be sent to answer a questionnaire and can be given time on the system if their answers are satisfactory. Users can be sent directly into the conference structure, visiting sysops can go directly to the file area, and so on. You have an unlimited degree of user fine-tuning with ease. This feature is exceedingly handy in a company-operated BBS system, where different departmental callers can be routed to their own private areas.

The last data file is USERS.DL, which sets the upload and download paths for the system. With dBBS you can not only use any path structure you want but also you can have separate paths and download and upload areas for different conferences, different departments, different categories of users, or any other division you select. You have a powerful questionnaire script language with conditional options. You can adjust the time on-system for different classes of users and can automatically exit from the system for a timed event, such as a backup. The program allows for messages as long as 75 lines. You can have an unlimited number of users, and unlike RBBS-PC, you do not have to predefine and/or pack your users' file.

Aborted uploads were always a problem with RBBS-PC because the aborted file stayed on the system. With a bad line condition, you might wind up with three or four different names for the same file before the user sent you a good copy. With dBBS an abort wipes out the upload, and the user can send again with the same name. DBBS also gets upload information before the file transmission, an advantage over RBBS-PC, where the information is asked for after the upload.

From the sysop standpoint, dBBS has excellent error checking. It allows you to upgrade a user while in CHAT mode. You can view and/or upgrade a user while reading comments or mail from the user. It helps you purge the board of stale messages by allowing you to force a purge of private messages.

I liked what I saw when I set up the single-user system, but the crucial test was yet to come. It was now time to set up the network. It took some doing to get the network running even before I reached the point of attempting to install dBBS. After about two days of hard work, I was satisfied that the network was working properly. I then started to install the bulletin board.

I did not understand the rationale behind Dan Doman's four-page network documentation. It seemed skimpy at the time and still does (although he promises it is being revised and expanded). It comes down to the fact, however, that each network installation is unique and that you have to come back to him for help. (Would you believe, he yelled at me for not calling him with a problem?)

I got the system up pretty fast, just as soon as he had clarified how to implement the lockfile structure. It then took about a

```
***** directory search path for "N" and "L" commands on "ALL"
FULL 99
**** name of bulletin menu, name of bulletin tag , number of bulletins
**** available
d:\dbbs\BULLET BULLET 12
```

Listing 3—PC Network parameters

```
: *** Network Batch File ***
PATH=c:\;c:\system;c:\network;c:\brief;d:\dbbs
NET START SRV AT /SRV:1 /ASG:15 /MBI:512 /REQ:3 /RQB:16384 /SHB:12800 >>>>
   >>>>    /NBC:12 /NBS:2650 /USN:0 /RDR:4 /SHR:20
NET SHARE DISKC=C:\
NET SHARE DISKD=D:\
NET SHARE DISKE=E:\
NET SHARE DISKF=F:\
NET SHARE DISKG=G:\
NET SHARE DISKH=H:\
NET SHARE DISKI=I:\
NET SHARE DISKJ=J:\
COPY d:\dir\full.dir j:
COPY d:\dir\new.dir j:
COPY d:\dir\tech.dir j:
COPY d:\dir\util.dir j:
COPY d:\dir\amiga.dir j:
COPY d:\dir\biz.dir j:
COPY d:\dir\game.dir j:
COPY d:\dir\mdm.dir j:
COPY d:\dir\blue.dir j:
COPY d:\dir\sigm.dir j:
COPY d:\dbbs\help* i:
COPY d:\dbbs\menu* i:
COPY d:\dbbs\wel* i:
COPY d:\dbbs\prelog i:
set node=3
prompt $p$g
BTIBMNET /M:64 /B:24 /C
NET SHARE|BSERVER /F:20 /H:30 /L:16
REM BREDIR only if not dedicated
```

Listing 4—The server's CONFIG.SYS file

```
lastdrive=Z
break=on
device=ansi.sys
files=100
buffers=30
device=vdisk.sys 48 512 32 /E
device=vdisk.sys 336 512 64 /E
```

Listing 5—Parameters for receivers

```
: *** Network Batch Fie ***
timer /s
NET START RDR XT2 /NBS:6400 /NBC:5  /ASG:10
NET USE C: \\AT\DISKC
NET USE D: \\AT\DISKD
NET USE E: \\AT\DISKE
NET USE F: \\AT\DISKF
NET USE G: \\AT\DISKG
NET USE H: \\AT\DISKH
NET USE I: \\AT\DISKI
NET USE J: \\AT\DISKJ
SET NODE=2
prompt $p$g
PATH=C:\BATCH;C:\APPS\TEXT;C:\APPS\DOS;C:\NETWORK;C:\;\D:\dbbs
D:
CD dbbs
bbs
```

Listing 6—The BBS.BAT file

```
BREDIR /R:24
DBBS-PCN.EXE %NODE% LOCKFILE
IF ERRORLEVEL 6 TIMEDEV.BAT
IF ERRORLEVEL 3 BBS.BAT
IF ERRORLEVEL 1 REBOOT.COM ECHO DONE
```

week to maximize the system speed. It was trial and error setting the many network parameters in the IBM software. Dan provided a customized version of Btrieve for the PC Network; I provided the patience to test each parameter. What I wound up with (as of this writing) by way of PC Network parameters on the server is shown in Listing 3. The server's CONFIG.SYS file is shown in Listing 4. My parameters for the receivers are shown in Listing 5. The BBS.BAT file is shown in Listing 6. When you set up a timed event, you implement it here as ERRORLEVEL 6.

Over the next few days, I called Dan almost every day and every day he patiently provided me with the help I needed to move on to the next step. If that sounds discouraging, it is not meant to be. I probably would have reached the same result on my own, but it was a great help to have someone easily reachable day or night who knew the answers.

BBS software is immensely personal, no matter how many people have contributed to it—RBBS-PC is a reflection of Tom Mack, dBBS is a reflection of Dan Doman, and I suspect PCBoard is a reflection of Fred Clark. To a certain extent, I was sorry that I had not started out with the single-user version of dBBS. RBBS-PC was a good training ground, however, and familiarity with it made me really appreciate how superior a package dBBS is. Seeing is believing, so I suggest that you call my system at (201) 886-8041 and find out for yourself.

The system pretty much takes care of itself now. DBBS comes complete with utilities that do everything necessary but automate directory handling. I felt a need to do just that, and therefore wrote a Clipper program (BBDIR) to do it. That program is available on my system and other systems as well as in the PC/Blue library (Volume 288). On that same volume are some great BBS utilities from Dan Doman.

Both dBBS and PCBoard provide free support for a year and have a nominal fee structure for additional periods. Both support 24-hour BBS systems for on-line updates. §

Steve Leon is a lawyer and computer hobbyist. He is also an active participant in the writing and distribution of Public Domain software.

Product Information

dBBS, Version 5.2a
$175 (single-user)
$300 (multiuser)
Daniel B. Doman
166 E, 96th St., Ste. 15B
New York, NY 10028
(212) 289-1020, (212) 289-1024.

PCBoard, Version 11.8
$119.95 (single-user)
$179.95 (multiuser, three nodes)
$50 (each additional node)
Clark Development Co. Inc.
P.O. Box 71365
Murray, UT 84107
(801) 964-6692.

PC Office Cards
$200 each
PC Office
7124 Convoy Ct.
San Diego, CA 92111

DESQview
$129.95; upgrades $50
Quarterdeck Office Systems
150 Pico Blvd.
Santa Monica, CA 90405
(213) 392-9851

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The Exec-PC BBS is available through either direct dial-up, or through a new service called Telenet PC Pursuit. Long distance callers enjoy PC Pursuit because it allows unlimited long distance calling for $25 per month. The PC Pursuit service is offered by GTE/Telenet. Contact them at 1-800-835-3638.

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Telephone (_____) _____

Name you will use for Logon to BBS (required)

First _____ Last _____

Four Character Password _____

RBBS-PC

by Dave Crane

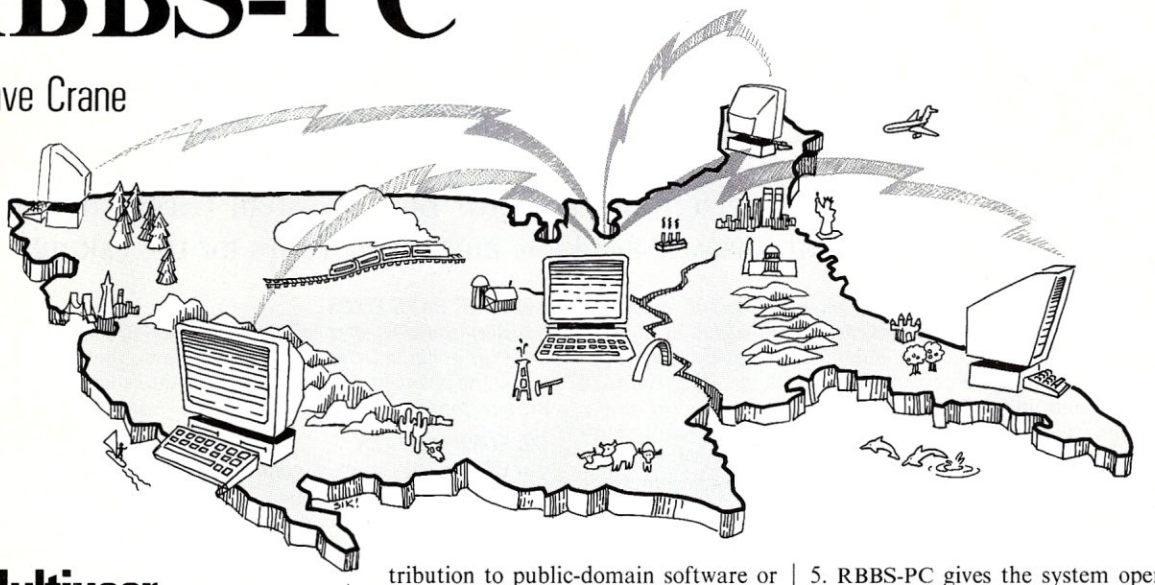

ILLUSTRATION BY JOE SIKORYAK

A Multiuser Public-Domain Bulletin-Board System

My bulletin board, Dallas RBBS-PC, has been operating for four years on the "same" early model IBM PC, though I admit to a few improvements. It now has 640K, runs at 7.4 MHz, and has two hard-disk drives (a total of 128 Mbytes). It supports two USR Courier 2400 modems, and I do file maintenance in the foreground partition under Sunny Hill Software's Taskview multitasking extension to DOS.

A professionally run bulletin board must support message bases and file downloading. The caller interface should be easy to understand, yet have advanced features for those needing them. That describes RBBS-PC.

RBBS-PC has been in the capable hands of Tom Mack of the Capital PC Users' Group since July 1983. As of Release 15.1A dated 15 March, 1987, Tom has distributed 28 improved releases. As a result of his efforts, and many who have helped him, RBBS-PC has become the standard by which all other bulletin-board software must be measured.

Six Reasons for Using RBBS-PC

1. RBBS-PC is free, and the BASIC source code comes with it. Tom suggests a contribution to public-domain software or to the Capital PC Users' Group if you feel you owe something. I can't think of any other BBS software that comes with source code, much less with such generous maintenance.

2. The caller interface to RBBS-PC is very easy to understand and use. The novice menus, as well as the expert-level abbreviations, have almost become a standard. Many other RBBS systems follow RBBS's conventions of "R" to read messages, "E" to enter a message, "K" to kill one, and so on. The latest release even allows you to choose your own command codes if you wish.

3. It has multiple messages bases called Conferences. Each can be public, private, or restricted to callers above certain security levels. 64K different security levels are possible.

4. Callers can upload or download with ASCII, MNP, XMODEM, YMODEM, IMODEM, or KERMIT protocols. RBBS-PC XMODEM supports both checksum and CRC as well as 128-byte or 1,024-byte transfer blocks. Both XMODEM CRC and 1,024-byte blocks are important for callers going through packet networks such as PC PURSUIT. CRC is mandatory on noisy lines, and 1K packets significantly increase transfer speed whenever line turnaround time is a problem.

5. RBBS-PC gives the system operator a lot of flexibility in system configuration. It supports multiple lines through a variety of multitaskers (DoubleDOS, MultiLink, DESQview, and so on) or multiple systems through a variety of LANs (Corvus, Orchid, and Fox Research's 10 Net are officially supported. IBM Token-Ring support is available but not yet integrated with the official releases). RBBS-PC also supports up to 31 Alloy PC-Slave/16 cards in the same PC. The current limit on concurrent callers is 36 copies of RBBS-PC sharing the same files.

   All system parameters can be separately defined for each incoming telephone line. For example, each line can upload to a different drive and directory; each line can have the same download directories available (or fewer, or more) and each can have the same Users' Messages and Conferences, or a different set, or some combination.

   RBBS-PC has many other features for assisting the system operator—too many to review here. The best way to understand RBBS-PC is to read the 135 pages of documentation that come with it and then experiment with a simple, one-caller system; a modem isn't even necessary in "workstation" mode.

6. Advanced, optional functions of RBBS-PC include Doors and Questionnaires. The latter are "question and answer forms" that callers may be asked to fill out either when they enter or when they

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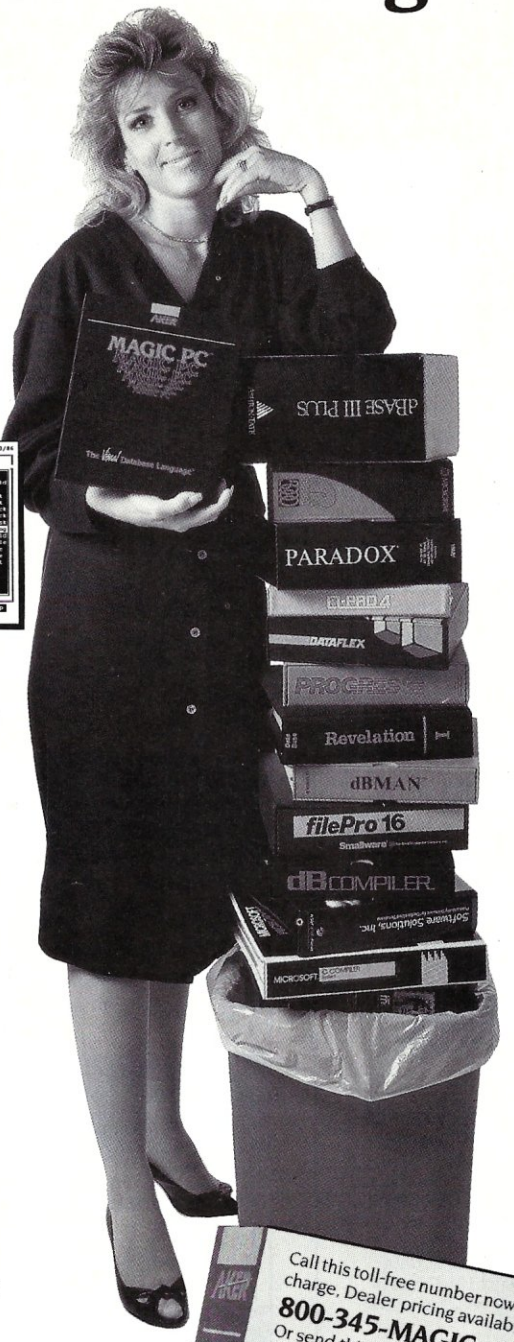

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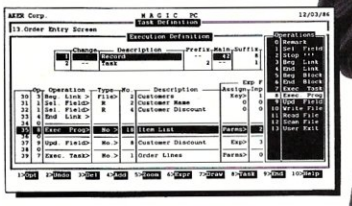

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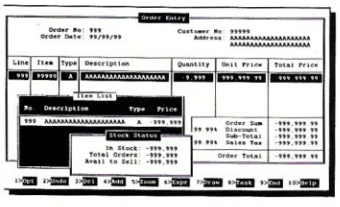

Magic PC's phenomenal Zoom power magically co-executes related programs through nested Zoom windows smoothly with auto data scrolling in all directions. While Zooming, query and transfer data across windows or even Zoom deeper.

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leave RBBS-PC. The system operator designs the form with a special script language recognized by RBBS-PC.

Doors are a method by which callers can terminate RBBS-PC and execute a DOS batch file while still connected online. The system operator can make any program available that will communicate with the caller's modem (serial port). Control normally returns to RBBS-PC and the caller continues online after he "closes" the Door. The system operator can optionally construct a Door or a DOS shell by which he or she actually gets remote control of the computer at the DOS command prompt.

What would I change in RBBS-PC if I could?—very little. I do wish that RBBS-PC were reentrant so that multiple callers could be supported without multiple copies of RBBS-PC. Each copy of Release 14.1D required a minimum of 170K—but a DOS shell cannot also be accommodated in such a small space. Multitasking software memory requirements are in addition. Therefore, a maximum of only two copies of RBBS-PC can be run in a 640K machine. I suppose if I really needed that feature, I would stop everything and help rewrite RBBS-PC. That's the beauty of Tom Mack's concept of "users helping users." Tom has done a marvelous job with RBBS-PC. The Release 15.1A documentation says it just as I would:

"RBBS-PC's policy of freely distributing the source code and continually expanding its range of capabilities throughout these last four years represents not only the very best that is embodied in the concept of 'users helping users' but an expectation of excellence that NO product in the PC industry has ever even approached."

I can't think of any other BBS software that comes with source code, much less with such generous maintenance.

If you have a mailing address in the United States and would like a copy of RBBS-PC on two 5¼-inch, nine-sector, double-sided, PC-DOS-format diskettes, send $8 and a request for Diskette #18 to Capital PC Software Exchange, P.O. Box 6128, Silver Spring, MD 20906.

If you want the documentation only, it is available in hard copy for $5.00. You will need to specify one of two formats: 8½ × 11, or IBM PC-manual size. Send your order to: Michael L. Brown, Nicolet Instrument Corp., P.O. Box 4288, Madison, WI 53711-0288.

You can also download the latest copy of RBBS-PC from several boards in the United States and abroad. Tom Mack maintains a two-line system in Virginia at (703) 759-5049 and (703) 759-9659. Ken Goosen also has two lines in Virginia at (202) 537-7475 and (202) 537-7945. Jon Martin has a system in California at (415) 689-2090. §

Dave Crane has been involved in computers since 1964 when he was a graduate student in geology at Rice University. In 1978, after 13 years with IBM, he left to form his own computer consulting company; D.C. Crane Inc., in Dallas, Texas.

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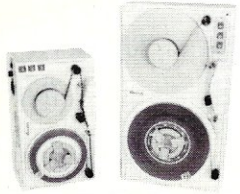

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MAKING COMPUTERS WORK MAGIC SINCE 1983

Bulletin-Board Systems

by Arne Strand

A Summary of Public-Domain and Commercial BBS Systems and Tools

Apart from commercial applications of BBSs (such as customer-support lines), it is irresistible to many would-be sysops to have what Tom Mack, author of the popular RBBS system, has called your "own soapbox in a national Hyde Park." In most cases the new sysop is a seasoned user of other BBSs and larger on-line systems, and the opportunity to "do it right" can be quite appealing. Would "sprouting like weeds" be overstating the current proliferation of BBSs? (One list of such systems in the Dallas-Fort Worth area alone contains 265 of them up and running—and several that I call often are not on the list!)

Actually setting up your own BBS, although just as rewarding (or more so) as learning to use any other reasonably sophisticated software system, is also just as frustrating (or much more so).

The Problem

The central problem is that there is currently no way to evaluate the software and the required hardware except by trial and error—a process that can become very tiresome after the first few hundred hours!

So what else is new? Isn't that the same problem you have to face when choosing an editor, or spreadsheet, or any other software? It is, but the problem is particularly tedious for BBSs for several reasons:

1. There are few dealers that can provide hands-on demos of even one BBS system, much less side-by-side comparisons.
2. There are no independent consultants to provide unbiased advice on various systems. Relatively rare is the sysop who is not quite fond of his or her own system. Rarer still is the sysop who has actually set up and used more than one system for any length of time. And unheard of is the sysop who has used and carefully evaluated more than two (the current one being by far the better!).
3. A real-world evaluation, whether by a computer journal or a cautious would-be sysop, does require a commitment of time and effort (and hardware that you may be loathe to dedicate to a single use). It also requires usage by callers who call randomly, leave messages, download files, and so on. And it requires tracking down the effects on the system and on your callers of staged (or real) power outages. BBSs provide a wonderful opportunity to become intimately familiar with the quirks of your local power company and telephone system.
4. A BBS is not only software. It is also a collection of modems, phone jacks, special communications cards in some cases, disk storage, backup hardware and software, and operating environments. If you are doing this for enjoyment and are not concerned with how many people call or how hard it is for them to get through or stay connected, these problems are minimal. But if you have some serious business or personal plans for your system, good luck! The problem is compounded by the fact that many BBS software products have notoriously poor documentation regarding compatible modems and other hardware.
5. Despite the growing number of BBSs, the market for such systems is probably not large enough for mass-circulation computer magazines to sponsor comprehensive feature-by-feature comparisons, as is done regularly for other software and hardware products. Also, even if there were many more readers interested in being sysops, the previous reasons make such comparisons exceedingly costly and time-consuming for magazines as well as for individuals.

When you settle on a combination of hardware and software for an evaluation period, perhaps just by copying the configuration of the system you like most as a user, you bring the system up and calls start coming in—quite a thrill. Before long, you may have accumulated a large number of registration, message, and other files for the system. You will also have accumulated expertise on handling the system's quirks and bugs—at least enough so that you can warn users about them! The prospect of then changing to another system may be so unappealing that it influences your decision on whether or not any further evaluation is really necessary. Most BBSs, by the way, do not have utilities for translating user files from other systems, although dBBS, for example, does.

On the other hand, if usage is small, you may wonder whether it was your system's hardware, the look and feel you gave the system when you configured the software, the whole concept of your board (if it was

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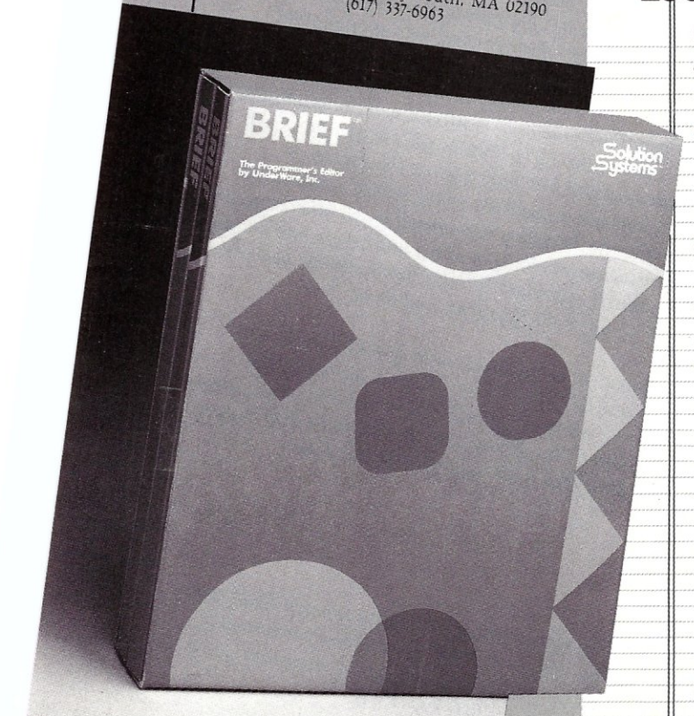

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meant to attract, for instance, callers who are interested in your favorite hobby), or any of a million other possibilities. At any rate, what occurs to you at that point may well be, "What other use could I be making of my computer?" and not "What BBS should I evaluate next?"

Available BBS Software

For those few thousands of you to whom, like myself, the lure of setting up your own system makes the obstacles seem less than insurmountable, I present for your enjoyment some lists of BBS software. Table 1 lists public-domain systems, and Table 2 lists commercial systems. The lists describe briefly several BBS (bulletin-board system) and CCS (computer-conferencing system) software products. BBSs frequently include conferencing (categorized message posting and exchanging), but CCSs frequently do not include other BBS features (such as program download and so on). The message keyword-search and editing features on CCSs, however, are frequently considerably more extensive than on BBSs.

Conferencing, in the sense of near real-time, on-line chatting (as on CompuServe's CB Simulator or People/Link's Party Line), is referred to in the notes accompanying the lists as "chatting."

Many of the most-popular public-domain systems are listed. To those programmers who have labored long and hard to create what is by far the "best" system, only to notice its absence from the list, I offer my sincerest apologies. (Let's see, there's SeaDog, and StoneHenge, and No-Change, and Citadel, and ROS, and ...) All these and probably some that I've never heard of are widely available on local bulletin boards, which you should check for the latest version, author information, suggested contribution, and so forth.

As for commercial BBS products, although the list is longer (and probably growing faster) than that of public-domain systems, there are also some others that I should have mentioned. All developers of commercial systems, please send me copies of your product and also the hardware it runs on. It's the only way I know to make sure you don't get left off the next list!! Seriously, I would be glad to receive brochures on any product I may have overlooked and also price or version update notices on the systems that are listed here.

Writing Your Own BBS System

Several of the systems I've listed were written using communications toolkits

Table 1. Public-Domain Systems

Collie	*Revision by Dan Plunkett of the Colussus BBS (by John Friel of QModem renown). Written in Turbo Pascal, Collie has many of the features of more mature systems, although Version 1.0 is still the current one. It also supports the FIDONET type of networking.*
Common Ground	*CCS written by Chris Hancock with an academic environment in mind. Written in Turbo Pascal using Blaise's Asynch Tools, this system is described in* Byte *magazine, December 1985.*
FIDO	*The second most popular public-domain BBS (after RBBS), and the first to implement author Tom Jennings' concept of a network of linked BBSs (nodes) capable of automatically forwarding packets of mail to each other. Unfortunately, unlike RBBS, source code for FIDO is not available. Widely used not only because of its networking ability but also, for instance, for customer-support BBSs (BYTEnet, Leading Edge, and so on).*
Genesis	*Turbo Pascal BBS (a .COM file and 18 overlays at last count) written by Kiriwuth Path and Jim Berg. Genesis is currently in Version 1.5, has many standard BBS features, and also has ANSI screen support. New file-transfer protocols have been added, and other enhancements are being made. Executable code is available as shareware, and source code is available for a relatively modest donation to the Genesis Project.*
OPUS	*One of the newer (October 1986) and many would say better entries among BBS systems, OPUS is written in Microsoft C. Seasoned sysops appreciate its configurability as well as its performance and continuing enhancements, even though the C source code in not currently available.*
RBBS-PC	*By far the most popular and in several ways the most mature BBS system (currently in Version 15.1), Tom Mack's RBBS-PC is written in compiled BASIC. You may deplore this choice of language, but widespread availability of the BASIC source code (via Maryland's Capital PC Users' Group and many other sources) and continued enhancements by Tom Mack and others have made this system the industry standard. It has error handling, network support, "doors" to other PC functions, and so on.*
Red Ryder Host	*Roughly the equivalent in the Mac world of RBBS in the MS-DOS world. It's available from Scott Watson, author of the popular Red Ryder communications program for the Mac, upon becoming a registered Red Ryder user. Excellent on-line support is available for both Red Ryder and Red Ryder Host.*

Table 2. Commercial Systems

BBS-PC Price: $150-$250 **Micro-Systems** 4301-18 Oak Circle Boca Raton, FL 33431 (305) 391-5077	*Business-oriented BBS that supports 1200/2400-bps operation. It has been difficult to obtain information on this product, but an on-line demo is available at (305) 737-1590.*

Table 2. Commercial Systems—*Continued*

Business Board
Price: $99
Hawkeye Grafix
Box 1400
Oldsmar, FL 33557
(813) 786-8161

"Business information center" supporting 300/1200/2400-bps. Customizable multilevel menu, supports remote operation and database interface. Source code available at extra charge.

Caucus
Price: single-user MS-DOS version, $350 range
Camber-Roth
243 Hoosick St.
Troy, NY 12180
(518) 273-0983

CCS system designed for on-line staff meetings, professional forums, ongoing legal discussions, and so on. Extensive message search and retrieve capabilities. Written in C. MS-DOS, UNIX, VAX versions available.

Chairman
Price: single-line, $295; six-line, $995
Dynamic Microprocessor Assoc.
545 Fifth Ave., Ste. 1103
New York, NY 10017
(212) 687-7115

Permitting up to six simultaneous users, Chairman is based on DMA's Ascom IV communications software and script language (which includes a multitasking executive). Network and database-oriented version forthcoming. Requires Arnet card for more than two users.

dBBS
Price: single-user, $175; network version, $300
Daniel B. Doman
166 E. 96th St., Ste. 15B
New York, NY 10128
(212) 289-1020

Currently in Version 5.0, dBBS is written in C and assembly language and supports a variety of networking environments. Also includes utilities to convert other BBS files to dBBS. Very good user support.

DLX
Price: $100-$400, depending on version
Inner Loop Software
5456 McConnell, Ste. 120
Los Angeles, CA 90066
(213) 822-2800

Supports two-party chats and up to nine users through 300-9600-bps interface to DigiBoard COM/8 card. Designed for business or dating system use. User friendly but much less versatile than, say, RBBS-PC. More than two users requires DigiBoard COM/4 or COM/8 card.

Forem ST/PC
Price: $60
CommNet Systems
24 Randy Rd.
Framingham, MA 01701
(617) 626-1388

Up to 9600-bps, several file-transfer protocols (XMODEM, YMODEM, and so on). Very versatile from sysop viewpoint and economical. Versions available for IBM PC or Atari ST.

GalactiComm
Price: four-user version, $2,200-$4,500
GalactiComm Inc.
11360 Tara Dr.
Plantation, FL 33325
(305) 472-9560

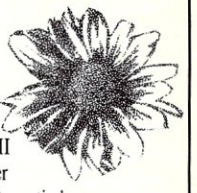
Supports multiuser use of all BBS functions (including chatting) and up to 64 users through interface to Xecom 1201 modems on custom-designed cards. C source code for a BBS system is available. Includes Xecom card and free C code.

MultiLink BBS
Price: MultiLink 4.0, $495

Part of MultiLink Advanced 4.0 multiuser, multitasking software. Runs in a 128K partition of

Rack & Desk PC/AT Chassis

A Fresh Approach



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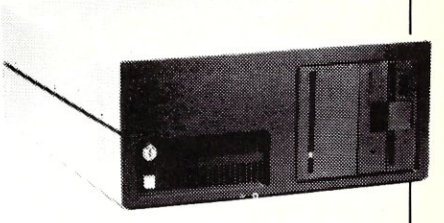

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available commercially—Common Ground used the Blaise tools, dBBS used the Greenleaf tools, and so on. Table 3 contains a list of some of the software toolkits available for such projects.

If none of the available BBSs have the features you or your clients are interested in, and you want to save yourself and your gastrointestinal tract some trouble, consider purchasing one of these products rather than starting from scratch. Several of the toolkits contain demo terminal programs, and the toolkit from Essential Software contains a small, demo BBS program.

Another starting point, somewhat higher-level than the C toolkits, would be to use one of the increasingly versatile communications-oriented script languages that many communications products are including as part of the package, such as the Ascom IV script language used to develop Chairman and included as part of the Chairman system.

A Final Suggestion

Recently, to promote its PC implementation of Common LISP (TransLISP PLUS), Solution Systems of Norwell, Massachussetts, has been distributing the LISP source code for an expert system called SELECTWP. This system prompts users with criteria to be met in using a word processor and helps them choose the best system for their needs. The program claims it is using AI to solve real problems—good idea, Solution Systems.

Perhaps some enterprising individual or company would be interested in developing an expert system—say, SYSOP.LSP or SYSOP.PRO. The knowledge of scores of micro communications programmers, modem manufacturers, sysops, and so on, could be integrated into an expert system that would assist the would-be sysop in selecting BBS software, modems, disk drives, and so forth. It would also provide advice on how to handle all the common problems that individual sysops are currently having to find out the hard way. Its design would naturally be flexible enough to incorporate new "rules," say, that the sysop wants to add, and, of course, it would also . . . ah well! §

Arne Strand is a computer programmer with interests in microcomputer communications and artificial intelligence at Custom Programming Services Inc., Dallas, Texas.

Table 2. Commercial Systems—*Continued*

The Software Link 8601 Dunwoody Pl., Ste. 632 Atlanta, GA 30338 (404) 998-0700	*MS-DOS. User friendly but very limited in most BBS functions (does include messages and file upload/download).*
PC-Board Price: Version 11.x, $80 and up, depending on number of nodes and support. **Clark Development** P.O. Box 71365 Murray, UT 84107 (801) 964-6692	*"Derived" from RBBS-PC. Like the public-domain RBBS, this is one of the more widely used IBM PC-oriented BBSs. Through Version 10, PC-Board was public domain.*
TBBS Price: $300; projected multi-user version, $900 **e-Soft** 4100 S. Parker, Ste. 305 Aurora, CO 80014 (303) 699-6565	*Business-oriented BBS, one of the first available commercially. Multiline version (up to 16 users) based on DigiBoard COM/8 cards projected for June 1987.*
TEAMate Price: basic BBS module, $495; all modules, $2,495 **MMB Development** 735 Deep Valley Rolling Hills Est., CA 90274 (213) 541-4504	*Multiuser system that runs under XENIX and includes modules for BBS, CCS, UNIX Mail, MCI Mail, distributed database, Lyrix interface, and so on. Supports as many users as your XENIX does.*

Table 3. Communications Software Tools

Blaise Computing 2560 9th St., #316 Berkeley, CA 94710 (415) 540-5441	*Asynch toolkits available:* *C—Asynch Manager, $175* *MS-Pascal—Asynch Manager, $175* *Turbo Pascal—Asynch Plus, $100*
Cytek Inc. 805 Turnpike St. N. Andover, MA 01845 (617) 687-8086	*C communications tools:* *Multi-Comm communications library, $150*
Essential Software P.O. Box 1003 Maplewood, NJ 07040 (210) 762-6965	*C communications tools:* *Essential communications, $185* *On-line monitor/debugger, $125* *Combined package, $250*
Greenleaf Software 1411 LeMay Dr., #101 Carrollton, TX 75007 (800) 523-9830	*C communications tools:* *Comm Library, Version 2.0, $185* *(includes DigiBoard interface)*
Invention Software P.O. Box 3168 Ann Arbor, MI (313) 996-8108	*Macintosh serial-port tools for Aztec C, Lightspeed C, Lightspeed Pascal, TML Pascal, $100*

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DLX-BBS and DigiBoards

by Clayton D. Strand

Evaluating a Nine-User Bulletin-Board System

As the information revolution continues, large-capacity microcomputers are radiating into application niches previously reserved for minicomputers and mainframes. Since the first microcomputers were developed, they have been used for communications over telephone lines. Large commercial communications networks developed for and running on mainframes and minicomputers, such as CompuServe and Delphi, have provided microcomputer users with access to other users in all parts of the country. At the same time these large information services have been growing, individual microcomputer users have developed an extensive network of single-caller bulletin-board systems (BBSs) to provide distribution of software and mail systems for individual users who access the host one at a time. Virtually the entire country is now served by these systems.

Although multiline operation is possible using products such as MultiLink or DESQview on these systems, near real-time interaction between callers has remained a feature of mini- and mainframe-based systems. Recently, software and hardware have been developed for micros that allow simultaneous multicaller access to a host microcomputer. As these systems mature, they will put the ability to provide real-time interaction among users within reach of the smallest enterprise. As has been the case with most other microcomputer applications, the most innovative and useful products have not come from the large, established software and hardware vendors.

Using the DLX-BBS

We recently had the opportunity to test the DLX Multiline Bulletin Board System (Version 3.1) from Inner Loop Software. DLX can operate as a one- or two-line BBS using standard serial ports configured as COM1 and COM2. Within the limitations discussed later, DLX provides many of the traditional features of single-caller BBSs as well as the facility for one user to "chat" with another who is on-line at the same time.

Using the COM/4 or COM/8 four- or eight-channel serial boards from DigiBoard, the system can also be configured as a three- to nine-line system on a single IBM PC or compatible microcomputer. We tested the DigiBoard COM/8 board, which plugs into the standard PC bus and provides eight asynchronous serial communications ports on one board. With one modem connected to the COM1 serial communications port and eight modems connected to the DigiBoard COM/8 board (configured as COM2 through COM9) up to nine users can be simultaneously on-line.

DLX is written in IBM Pascal and 8088 assembly language (the source code is available for a hefty $20,000). It requires MS-DOS or PC-DOS, Version 2 or later, but the vendor recommends Version 3 or later for hard-disk efficiency. The host computer must have 512K RAM and a hard disk. The vendor recommends an AT and AT-type hard disk if you are implementing a system that will be used for simultaneous file transfers by several users.

Generally, DLX provides for file transfers using XMODEM and ASCII protocols and 50 message boards for special-interest groups (SIGs). Up to five SIGs can have a special-interest survey associated. The system comes with preconfigured user interfaces for a computer dating service or a general business application. Unfortunately, callers can not be recognized by their normal names; they are expected to remember an assigned number coupled with one name, or a handle.

Documentation

The system documentation for DLX consists of a seven-page, copy-quality sysop manual that is reasonably useful. For unsophisticated users, the manual has some deficiencies, however. Sysop commands are not explained in enough detail, and the ramifications of setting particular param-

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ASMLIB *Function Library by BC Assoc*	149	125
asmTREE *B-Tree Dev System by BC Assoc*	395	329
Cross Assemblers *Various by 2500 AD*	CALL	CALL
EZASM *by C Source* *New*	70	64
Microsoft Macro Assembler *New Version*	150	93
Norton Utilities *by Peter Norton*	100	CALL
Norton Utilities (Advanced)	150	99
Turbo Debugger *by Speedware* *New*	89	79
Turbo Editasm *by Speedware*	99	84
Visible Computer: 80286 *New*	100	89
Visible Computer: 8088 *by Software Masters*	80	64

basic language

87 Software Pak *by Hauppauge*	180	149
db/Lib *for QuickBASIC by AJS Publishing* *New*	99	89
EXIM Services Toolkit *by EXIM*	50	45
Finally *by Komputerwerks*	99	85
MACH 2 *by Micro Help*	69	55
Microsoft QuickBASIC *$20 Rebate Offer*	99	63
QBase *Relational Database by Crescent* *New*	89	79
Quick-Tools *by BC Associates*	130	109
QuickPak *by Crescent Software*	69	59
Scientific Subroutine Library *by Peerless*	125	99
Screen Sculptor *by Software Bottling*	125	91
Stay-Res *by MicroHelp*	69	55
True Basic *w/Run-time* *Special Price*	200	99
True Basic	100	79
Run-time Module	100	79
Various Utilities	50	41
Turbo BASIC Compiler *by Borland Intl*	100	64

blaise products

ASYNCH MANAGER *Specify C or Pascal*	175	135
C TOOLS PLUS	175	135
LIGHT TOOLS *for Datalight C* *Special Price*	100	65
PASCAL TOOLS	125	99
PASCAL TOOLS 2	100	79
PASCAL TOOLS & TOOLS 2	175	135
RUNOFF *Text Formatter*	50	45
TURBO ASYNCH PLUS	100	79
TURBO C TOOLS	129	CALL
TURBO POWER TOOLS PLUS	100	79
VIEW MANAGER *Specify C or Pascal*	275	199

borland products

EUREKA *Equation Solver*	167	105
Reflex & Reflex Workshop	200	128
Reflex *Data Base System*	150	89
Reflex Workshop	70	45
Sidekick & Traveling Sidekick	125	85
Sidekick	85	57
Traveling Sidekick	70	45
Superkey	100	64
Turbo BASIC Compiler	100	64
Turbo BASIC Database Toolbox *New*	100	64
Turbo BASIC Editor Toolbox *New*	100	64
Turbo BASIC Telecom Toolbox *New*	100	64
Turbo C Compiler *(Call for support products)*	100	64
Turbo Database Toolbox	70	41
Turbo Editor Toolbox	70	41
Turbo Gameworks Toolbox	70	41
Turbo Graphix Toolbox	70	41
Turbo Jumbo Pack	300	219
Turbo Lightning	100	64
Turbo PASCAL Numerical Methods Toolbox	100	64
Turbo PASCAL and Tutor	125	85
Turbo PASCAL	100	64
Turbo Tutor	40	24
Turbo PROLOG Compiler	100	64
Turbo PROLOG Toolbox	100	64
Word Wizard	70	47
Word Wizard and Turbo Lightning	150	94

c compilers

C86PLUS *by Computer Innovations*	497	375
DeSmet C *w/Debugger & Large case*	209	184
DeSmet C *w/Debugger only*	159	138
Eco-C *Complete System by Ecosoft*	140	119
Lattice C Compiler *vers. 3.2 from Lattice*	500	265
Mark Williams Let's C w/csd	125	99
Microsoft C Compiler w/CodeView *New version*	450	269
Microsoft QuickC Compiler *New*	99	63
Optimum-C *by Datalight*	139	105
Turbo C Compiler *by Borland*	100	64
Uniware 68000/10/20 Cross Compiler *by SDS*	995	829

c interpreters

C-terp *by Gimpel, Specify compiler* *New Version*	300	219
C Trainer *with Book by Catalytix*	122	87
Instant C *by Rational Systems* *New Version*	500	369
Introducing C *by Computer Innovations*	125	99
Run/C *by Age of Reason*	120	69
Run/C Professional *by Age of Reason*	250	145

c utilities

C++ *by Guidelines w/version 1.1 kernel*	195	172
Csharp Realtime Toolkit *by Systems Guild* *New*	600	539
c-tree & r-tree Combo *by FairCom*	650	519
c-tree *ISAM File Manager*	395	315
r-tree *Report Generator*	295	239
Data Windows *by Magus Inc* *New*	245	209
with Source Code *New*	595	499
dBx *dBASE to C Translator by Desktop AI*	350	299
with Source Code *New*	550	469
Flash-up Windows *by Software Bottling*	90	78
GraphiC *Color version by Sci Endeavors*	350	282
GRAFLIB *by Sutrasoft*	175	159
HALO *Graphics by Media Cybernetics*	300	205
HALO Development Pkg *for Microsoft*	595	389
The HAMMER *by OES Systems*	195	129
PANEL *Forms Management by Roundhill*	295	215
PANEL/TC *for Turbo C by Roundhill* *New*	129	95
PANEL Plus *by Roundhill*	495	395
PC Lint *by Gimpel Software*	139	99
PLOTHP *by Sutrasoft*	175	159
RTC PLUS *Fortran to C by Cobalt Blue*	450	399
Scientific Subroutine Library *by Peerless*	175	135
TE Text Editor *source by Sub Systems* *New*	95	85
Vitamin C *by Creative Programming*	225	158
VC Screen *Forms Designer*	100	79
Zview *by Data Mgmt Consultants*	245	139

cobol language

COBOLspII *by Flexus*	395	329
FPLIB *for Realia COBOL by BC Associates*	149	129
Micro Focus COBOL *See Micro Focus Section*		
Microsoft COBOL *See Microsoft Section*		
PCDT *by Pro-Code* *New*	995	895
Realia COBOL with RealMENU *New Version*	1145	899
Realia COBOL *New Version*	995	783
RealCICS	995	783
RM/COBOL *by Ryan-McFarland*	950	CALL
RM/COBOL 85 *by Ryan-McFarland*	1250	CALL
SCREENIO *by Norcom* *New*	400	379
screenplay *for COBOL by Flexus*	175	129

css products

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PC/TOOLS *UNIX-like Utilities*	49	45
PC/VI *vi Editor*	149	99

debuggers & profilers

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Advanced Trace-86 *by Morgan Computing*	175	115
Codesmith-86 *by Visual Age*	145	98
DSD87 *by Soft Advances*	125	79
MiniProbe *by Atron*	395	369
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TURBOsmith *Source debugger for Turbo Pascal*	69	59
The WATCHER *Profiler by Stony Brook*	60	51

disk utilities

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FASTBACK *by 5th Generation Systems*	179	129
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dos utilities

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forth language

CFORTH *Native Code Compiler by LMI*	300	229
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fortran language

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lattice products

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microsoft products

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modula-2 language

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mouse products

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Microsoft Mouse *See Microsoft Section*			

other languages

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other products

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MACH 2 *for Turbo Pascal by Micro Help*		69	55
MetraByte D/A Tools *by Quinn-Curtis*		100	89
Science & Engrg Tools *by Quinn-Curtis*		75	67
Screen Sculptor *by Software Bottling*		125	91
Speed Screen *by Software Bottling*		35	32
System Builder *by Royal American*		150	129
IMPEX *Query Utility*		100	89
Report Builder		130	115
TDebugPLUS *by TurboPower Software*		60	49
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dBx *with Library Source by Desktop AI*		550	469
Desqview *from Quarterdeck*	*New*	100	85
DOSIX *Console Version by Data Basics*		399	349
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Informix *All Varieties by Informix*		CALL	CALL
Micro Focus Products *See Micro Focus Section*			
Microport Products *See Microport Section*			
Microsoft Products *See Microsoft Section*			
PANEL Plus *by Roundhill Computer Systems*		795	535
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SCO Products *See SCO Section*			

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eters within the configuration file are not discussed at all. (After we began this evaluation, Inner Loop Software issued a free upgrade to Version 3.2 for all current users, with a new 14-page sysop manual that was more complete but we did not have time to evaluate it in detail.) The lack of detail concerning modem configurations, other than the Hayes internal and external modems, was particularly annoying (and remains in the Version 3.2 manual). Any communications software product ought to contain the switch settings and setup commands for dozens of modems. We recognize that this is a difficult task for a new product from a small company, but lack of documentation of this type is a major weakness for any communications product.

The documentation provided by DigiBoard for installing the COM/8 board was also inadequate and confused the issue further. In fact, proper installation of this board required a phone call to Inner Loop Software.

Performance

The bulletin-board software operates as advertised. Access to system features is controlled by a hierarchical system of numeric access codes that also control the daily system-access time for a particular user with the given code. Only nine codes are provided, and each higher-level user has access to all features available to all lower-level users. A better designed access system, which would optionally allow access by full names and both more codes and codes for exclusive access at the same user level, as most single-line BBSs provide, would be preferable.

Uploading and downloading files, limited to the protocols mentioned earlier, is more restricted than experienced users of BBSs might like. The system also provides only one set of modem configuration parameters and one modem setup command for all lines, which effectively restricts the host system to one brand of modem (or perhaps several brands of very highly compatibles). Worse, if one modem must be reconfigured and reinitialized, the entire system must be reinitialized. A modem configuration file and a command for each line would be better.

The "chat with another caller" feature is DLX's main attraction. As implemented, any caller can page any other active caller to initiate a two-party conversation. Like direct computer-to-computer links, keyboard entries are handled on a character-by-character basis, so patience is required to prevent interleaving. Conversations between more than two callers are not supported presently.

The software accounting system is virtually undocumented in Version 3.1 of DLX. An examination of the members' file showed that the accounting system was tracking the total number of calls and the access time remaining that day for each caller. For anyone wishing statistical information of this type, the system must be taken off-line each day or the accounting file must be downloaded and user-developed accounting reports run. It is hoped that, in the future, facilities will be provided for the automatic generation of these reports within the program.

The user interface for both the sysop and callers is excellent. Neither novices nor experienced callers should have difficulty navigating through the board, and sysops reasonably familiar with the DOS operating system's facilities should have little difficulty configuring the system to taste.

System performance is mainly restricted by disk access contention. We were able to test concurrent downloads and two-party conversations with four callers on an IBM PC/AT with a Norton SI index of 5.7, at 1200 baud. No performance degradation was observed. The effective transfer rate was approximately 800

baud, regardless of the number of callers (up to four) or the functions they used.

Good error handling is absolutely essential for the successful operation of any communications host. During several weeks' operation, with only the few users a new bulletin board attracts, the system crashed once without indicating why. As this problem occurred early in the test, when we were still having problems configuring the modem parameters and did not reoccur, we must rate general host error handling as good. The system allows the sysop to kill individual lines or terminate execution, either gracefully or abruptly, when problems do occur. For callers, however, problems remain. One caller not authorized to post messages tried to post one to the sysop and was arbitrarily logged off without explanation. Other callers were logged off abruptly by the system for no obvious reason. (Idiosyncratic modems or invalid communications parameters are suspected.)

Support from Inner Loop Software is excellent. Although no toll-free, technical support line is provided, bulletin-board support for registered sysops is available 24 hours a day and voice support is available during normal business hours in California.

Telephone support for the communications board at DigiBoard, is also good. A toll-free number is provided, and knowledgable technicians answer it. The limited dealer network for this product practically guarantees that, in the case of failure of this hardware, you would have to mail the board to Minnesota for repair. If you purchase the board directly from DigiBoard, you can call the company and it will immediately dispatch a new board with an invoice. Upon receipt of the defective board, your account is then credited. DigiBoard is also presently negotiating with Inner Loop to develop a set of "quick start" parameters to allow an easier, correct installation with the DLX system.

This system is presently adequate for sophisticated users for whom multiline access is more important than common features available for single-line systems. The system's strongest point is its ability to allow callers real-time access to each other through its "chat with another caller" facility.

Inner Loop Software and DigiBoard have shown that they are committed to cooperate to improve this product. With the indicated improvements, and good customer feedback in the future, this communications system should be able to compete successfully with other products of this type.

Acknowledgements

Special thanks to Dave Crane and Arne Strand for providing technical assistance for testing and compilation of system characteristics. §

Clayton D. Strand has been involved with on-line computer systems and data communications since 1965. He was a founder of Custom Programming Services Inc., Dallas, Texas, and is presently Technical Services Director.

Product Information

DLX-BBS
Price: $400
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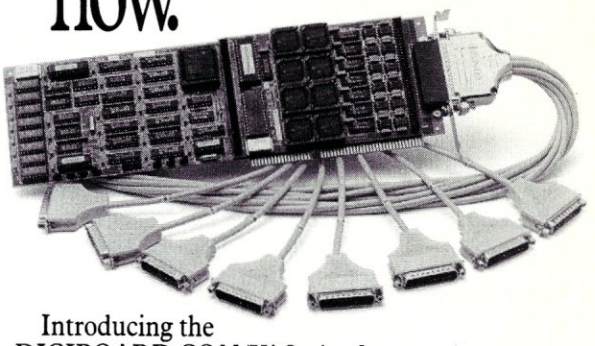

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FORTRAN Compilers For The PC

A Comparison of the Lahey, Microsoft, Ryan-McFarland, Prospero, & WATCOM FORTRAN Compilers

by Avram Tetewsky and Dan Feenberg

Most FORTRAN programmers want to know the features, extensions, limits, integrity, and performance of a FORTRAN compiler before committing to a system. The tables in this article should enable you to pick the system that best matches your needs.

We will focus on Lahey FORTRAN, Microsoft (MS) FORTRAN, Prospero (Pros) FORTRAN, Ryan-McFarland (RM) FORTRAN, and Waterloo Computer Systems (WATCOM) F77. These are the ANSI 77 compilers that are currently supported by their publishers. IBM and DRI also offer compilers, but they have not been supported in several years and are clearly less capable.

Overview

Table 1 presents an overview of FORTRAN compilers. Government certification is awarded by the National Bureau of Standards Software Standards Validation Group to compilers that successfully execute 193 test programs designed to expose any failure to comply with the ANSI standard. Some errors are allowed, but they must be corrected within a year for certification to be renewed. Prospero, RM, and MS FORTRANs are government-certified at this time.

Certification is a valuable indicator of quality but should not be confused with perfection. It is impossible to test every combination of langauge structures. In fact, it is possible to have a validated compiler that can't compile real-world programs.

All these products have terrible shrink-wrap warranties—only the disks are covered with a replacement guarantee. To be fair, as long as a vendor supplies an up-to-date list of known bugs and work-arounds, preferably via a free electronic bulletin board, the poor warranties can be tolerated. Lahey is the only vendor to run a free electronic bulletin board to receive reports and distribute patches. Although no compiler can be completely free of bugs and none of the vendors promise bug fixes in their warranties, we know of no violations of the standard that persisted through a subsequent version. We do think a written commitment would be a reasonable expectation. User support has also been good for all vendors.

It can be a nuisance to recompile libraries or wait for upgrades from third-party vendors for every new edition of a compiler. To date, only RM and Microsoft have attempted to supply at least one level of back compatiblity to "tide you over until third-party software vendors can update your software."

Compiler Features

Unfortunately, extensions to ANSI FORTRAN 77 are essential to make a truely usable compiler. Years of mainframe practice have made for several unofficial industry-standard extensions. Some of these are so widespread that few users realize they are not part of the language. Table 2 summarizes standard (i-stand) and some other extensions that you may want.

None of the compilers support extended precision or 8087 *REAL*10* 80-bit numbers (and their corresponding intrinsic functions) or have facilities to trap to your own numeric exception handler. At best you can control the number of exceptions that will be tolerated before your program is terminated.

All systems have implementation-defined limits and, although few programs will exceed the limit for the number of nested *DO* statements, a limit of 255 for the size of a character variable can be an overwhelming constraint, especially if you are porting a large program. The most severe limit for many PC FORTRAN users comes from the 640K hardware bound on

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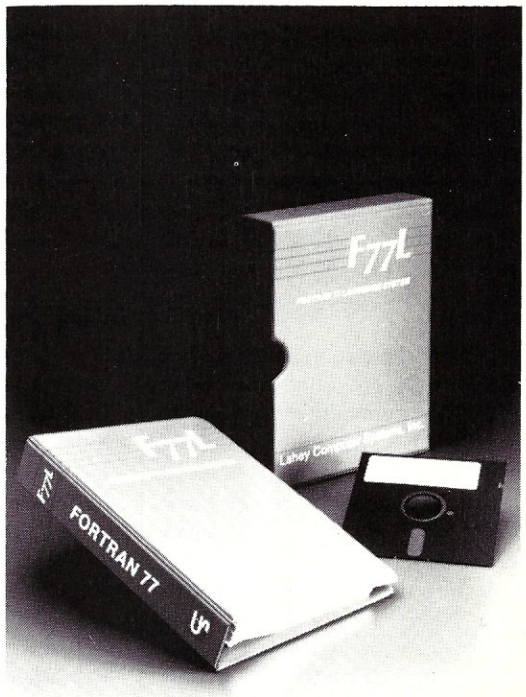

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user-addressable memory on the IBM PC. All these compilers, excluding their debuggers, can work with the Microway Number Smasher/ECM board to run with a full megabyte of storage. But no one yet supports the Lotus-Intel-Microsoft expanded memory hardware, and no vendor has yet announced any support for extended memory on the 286 or 386. Many of us are waiting eagerly for that operating system upgrade.

Although most vendors now list key limits in an appendix, the limits are still stated in terms that only another compiler writer could understand. In other cases, the limits can only be stated as a formula.

Interlanguage linking is becoming an important feature. The DEC VAX family of languages is a prime example of interlanguage linking at its best. On the VAX, you can not only pass parameters but also force FORTRAN *COMMON* to overlay global C structures or global Pascal/Ada records. Without Intel or Microsoft conventions, the PC world can never approach such facilities.

Every one of these compilers has some ability to invoke programs from other sources. Table 3 summarizes these facilities. Because FORTRAN stores multidimensioned arrays in column-row order, whereas all other languages use row-column order, you may have to transpose matrices or declare them in reverse order before passing them to non-FORTRAN languages. Note that Lahey and Prospero FORTRANs can use assembly-language utilities written for the Microsoft compiler.

Tables 4 and 5 summarize switches/options, manual, and other information that may be useful in picking a compiler. All the compilers have some form of subscript checking; however, WATCOM is the only compiler that checks dummy argument dimensions against the actual array argument. MS checks subroutine interfaces within a single file but only for subroutines defined before they are called.

Robustness and Benchmarks

Given all the preceding features, we tested each compiler to see first how robust it was—Did it generate correct object for almost all inputs? How long did that take to compile?—and last, how fast the executable code was compared to the 32-bit mini or mainframe computers FORTRAN programmers are used to.

In general, all benchmarks have been run on IBM PC/ATs with one wait state; DOS 3.2; and a CONFIG.SYS file with:

Table 1. Overview

	Lahey	MS	Pros	RM	WATCOM
Version	2.20	4.0	1.15	2.11	1.4
ANSI standard	77+	77+	77+	77+	77+
Certified	no	yes	no	yes	self
Debugger	yes	yes	yes	yes	yes
Assembler	no	no	no	no	no
Linker	DOS	link 4.0	prolink	prolink	not needed
Librarian	no	yes	yes	yes	no
Minimum 360K disks	1	4	1	1.5	1
Telephone support	free	free	free	free	free
Bulletin board	free	$$$	no	no	no
Newsletter	free	$$$	free	free	free
Last update cost	$70	$150	$?	$150	$?
Third-party vendors	listed	listed	listed	listed	listed
One-level-back compatible	no	yes	no	yes	n/a
Run-time royalties	no	no	no	no	site license
Warranty	none	none	none	none	none
Price	$477	$450	$495	$595	$375

Table 2. Compiler features and extensions

	Lahey	MS	Pros	RM	WATCOM
Long variable names	31 char	31 char	6 char	31 char	32 char
Long common block names	29 char	31 char	6 char	8 char	32 char
Subprogram names	31 char	31 char	6 char	8 char	32 char
Underscore in names	yes	yes	no	no	no
INCLUDE	i-stand	nonstan	i-stand	i-stand	nonstan
*INTEGER*n*	2,4	1,2,4	1,2,4	2,4	1,2,4
*LOGICAL*n*	1,4	1,2,4	1,2,4	1,4	1,4
*REAL*n*	4,8	4,8	4,8	4,8	4,8
*COMPLEX*n*	8,16	8,16	8	8,16	8,16
*CHARACTER*n*	65280	32767	32767	255	65535
Recursion	yes	no	no	no	no
IBM *NAMELIST*	yes	no	no	no	no
VAX BIT functions	most	yes	no	yes	no
IMPLICIT NONE	also switch	switch	switch	no	no
OPEN keywords/options					
APPEND	yes	no	no	yes	yes
BLOCKSIZE	no	yes	no	no	no
SHARING	no	yes	no	no	no
LIST or FORTRAN carriage control	yes	no	no	no	yes
Hex constants	i-stand	i-stand	nonstan	i-stand	i-stand
Other-based constants	no	yes	no	no	no
FORMAT					
hex editing	i-stand	i-stand	i-stand	i-stand	i-stand
suppress cr-lf	nonstan	i-stand	i-stand	yes	i-stand
Stream I/O	yes	yes	no	no	no
Preconnected units	5,6	0,5,6	5,6	0,5,6	5,6
Trailing line comments	yes	no	no	no	no
Type and initialization in one statement	yes	yes	no	no	yes
Mix char, numeric data in the same common	yes	yes		yes	yes
Do 66 option	yes	yes	yes	yes	no

Table 2. Compiler features and extensions—*continued*

	Lahey	MS	Pros	RM	WATCOM
Hollerith literals	yes	yes	yes	yes	yes
Read short records, and override formats	yes	yes	yes	yes	yes

Table 3. Interlanguage and other links

	Lahey	MS	Pros	RM	WATCOM
Assembler	yes	yes	yes	yes	yes
Pascal	no	MS	Pros	no	no
C	Lattice	MS	no	no	no
DOS independence for 8086/8088 non-PC embedded controller boards	no	some	yes	no	no
Pass arguments	yes	yes	yes	yes	yes
Overlay common with records	no	no	yes	no	no
Flip row-col/ col-row	no	no	no	no	no

Table 4. Switches and options

	Lahey	MS	Pros	RM	WATCOM
Strict 77 option	no	yes	no	yes	yes
Small	yes	yes	yes	no	no
Medium	no	yes	yes	yes	no
Large	no	yes	no	no	no
Huge/jumbo	yes	yes	yes	yes	yes
IMPLICIT NONE	yes	yes	yes	no	no
80286 code option	no	yes	yes	yes	no
Emulator for machines w/o 8087/80287	no	yes	yes	yes	yes
Run-time 8087/emul select	no	yes	no	yes	no
Turn optimization on or off	no	yes	no	yes	n/a
Save/nosave option	yes	always	always	always	always
Subscript checks	local	local	local	local	global
Check subprogram interfaces	yes	same file	no	no	yes
Check for uninitialized variables	no	no	no	no	yes
Protect constants	yes	no	no	no	yes
Free-format source input	yes	yes	no	no	no
Cross-reference list	yes	yes	yes	yes	no
Listings with assembly language	no	yes	no	yes	no
Change default switch values	yes	no	yes	no	yes
Compile multiple files	no	yes	no	no	no
Make utility	no	yes	no	no	no
Label object modules	no	yes	no	no	-

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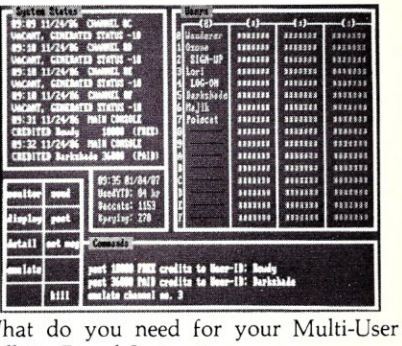

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```
stacks = 16,256
device=\dos\ansi.sys
files=20
buffers=20
```

Clock speeds are noted for each benchmark. All compiles were done with huge model, 8087 only, debugging checks off, no listings, 4-byte integers, and 4-byte logicals. Typical compile and link commands for a program split between two files are shown in Figure 1.

Most compile/link timings were done with the Microsoft utility TIMER.EXE—for example:

```
timer link file1+file2,file;
```

measures the linking time.

All test programs were tried on both an IBM 3090 and DEC VAX 8650 with all debugging options set on to ensure that the programs were legal and correct. Because WATCOM's FORTRAN is a load-and-go compiler with no link step and because it doesn't generate production-quality code, the first- and second-place winners in compile speed are noted for each test.

Six tests were run on each compiler to evaluate performance. The results are shown in Figure 2.

We are reporting execution times with all optimizations on. For MS FORTRAN, however, turning optimization off reduces compile time by 18-25 percent. There is no noticeable effect for RM FORTRAN compile times. For the numercial benchmarks, optimization buys roughly 30 percent performance gains for MS FORTRAN.

All MS .EXE files can be reduced by 2K if the text of error messages is removed.

Execution Benchmarks Across Other Machines

When comparing intermachine benchmarks, bear in mind that some computers do all math in double precision and truncate to get single precision whereas others have separate hardware for each. Thus the PC with the 8087 or the IBM 3090 typically show only small single-to-double-precision degradations whereas a VAX slows down significantly.

By using benchmarks that cover complex variables and arrays, a wide range of features can be tested. For example, machines that have good integer CPUs but poor floating-point units show better performance for problems that spend a lot of time on subscript addressing and bounds checking whereas the best floating-point unit wins for problems with complex

Table 5. Documentation

	Lahey	MS	Pros	RM	WATCOM
Help card	no	yes	no	yes	yes
Index	yes	yes	yes	yes	yes
Extensions highlighted, side-barred, etc.	no	yes	no	yes	noted
Assembly calls	yes	yes	yes	yes	yes
Unformatted file formats	yes	yes	yes	yes	yes
Limits noted in one section	some	some	no	most	no

Figure 1. Benchmark compile and link commands

Lahey:
```
f77L  file1
f77L  file2
\dos\link file1+file2;
where f77L.FIG contains
    /N0/N7/NA/NB/ND/NF/NH/NI/NL/O/P/R/S/NT/
    W/NX
```

MS:
```
fl /AH  file1.for file2.for
(lib = 8087, large model, no C or 3.2 compatibility)
```

Pros:
```
f77  file1 /J7
f77  file2 /J7
prolink file1,file2,f77lib7B/S
```

RM:
```
rmfort file1 /b
rmfort file2 /b
plink86 lib rmfort.lib fi file1,file2 output file1
```

WATCOM:
```
WATFOR87/exe file1
(WATCOM compiler allows only one file on command line although
    other files may be INCLUDED.)
```

Figure 2. Testing the compilers

Test 1: PC/AT 6/4-MHz 80286/80287. Sewing machine vision calibration program, which contains sequential files, substrings, 3D arrays, and nonoptimal code to give an optimizer something to do.

	Lahey	MS	Pros	RM	WATCOM
Compile time	**74.26 s	248.71 s	171.5 s	255.70 s	*31.20
Link time	33.07 s	*32.02 s	46.79 s	47.68 s	-
EXE size (packed)	67.95 K	54.02 K	*53.75 K	63.50 K	
Correct	*100%	95%	*100%	*100%	*100%
Exec time	75.30 s	*47.56 s	75.00 s	66.57 s	99.74 s

* *winner in this area*

** *second in this area for compile time*

Notes:

1. WATCOM compiler detected one uninitialized variable.

2. The MS compiler had difficulty writing a line longer than 150 characters to a file; a patch is now available.

Figure 2. Testing the compilers—*continued*

Test 2: PC/AT 6/4-MHz 80286/80287. Printer plotter routine containing CHARACTER*n and sequential file operations.

	Lahey	MS	Pros	RM	WATCOM
Compile time	**59.75 s	242.44 s	140.5 s	235.40 s	*17.63 s
Link time	*17.63 s	22.30 s	50.14 s	40.48 s	-
EXE size (packed)	65.27 K	54.17 K	*50.75 K	64.64 K	-
Correct	*100%	*100%	10%	*100%	*100%
Exec time	43.28 s	*22.13 s	-	48.06 s	60.75 s

* *winner in this area*
** *second in this area for compile time*

Notes:
1. Prospero FORTRAN log plots produced errors. After elimination of log plots, other plots still failed, although borders came out.

2. WATCOM compiler: test driver passes CHARACTER*n data into arguments expecting CHARACTER*1 arrays. Although this is not illegal, it was changed for the WATCOM run. This same change did not affect Prospero FORTRAN.

Test 3: PC/AT 6/4-MHz 80286/80287. Large-memory-model version of REMEZ, an IEEE digital signal-processing program that minimizes peak error in a filter FIR frequency response. Program was changed so that it contains large arrays embedded in common blocks. It is double-precision intensive, with no I/O in timed portion of program.

	Lahey	MS	Pros	RM	WATCOM
Compile time	**32.10 s	160.22 s	81.70 s	150.49 s	*12.53
Link time	*38.83 s	41.53 s	43.72 s	46.74 s	0
EXE size (packed)	54.41 K	48.50 K	*41.00 K	50.44 K	-
Correct	*100%	*100%	*100%	*100%	*100%
Exec time	30.42 s	*26.66 s	37.30 s	29.99 s	57.01

* *winner in this area*
** *second in this area for compile time*

Note:
For WATCOM, we had to shrink the REMEZ arrays to allow for the larger run-time library, but the amount of work done is not affected.

Test 4: PC/AT 8/5.33-MHz 80286/80287. Matrix operations, singular value decomposition from numerical recipes, a 50 × 50 double-precision version, no I/O, number crunching only.

	Lahey	MS	Pros	RM	WATCOM
Compile time	**17.30 s	104.58 s	45.58 s	83.32 s	*8.46 s
Link time	*18.13 s	23.29 s	29.16 s	28.29 s	-

arithmetic or simpler structures. Although the PC/AT with its 80286 is good at subscripts, it is bad at floating point because most PC/ATs clock the 80287 at two-thirds the speed of the 80286—hence an 8-MHz 8086/8087 beats an 8-MHz 80286 PC/AT for many benchmarks.

Features Everyone Should Have

Considering the number of features already present (Figure 3), it is clear that all these FORTRAN vendors deserve our congratulations, if not our support. Each has special features that might make it the compiler of choice for a particular purpose. Sometimes these special features did not require a great deal of work to implement, and features such as these are worth imitating. Virtue in language design depends more on careful imitation than on originality, and we hope all vendors will scan the tables here for ways in which to improve their compilers.

The WATCOM compiler is special because it is a load-and-go compiler that offers superb run-time checking. The remarkable compile times are purchased at the expense of longer run times, but careful attention to the detection of essentially all undefined conditions makes debugging quick and free of frustration.

Long variable names with underscores may seem a luxury to old FORTRAN hackers, but they are required under many military programming contracts and greatly improve the readability of code.

Manuals are important. IBM pioneered the use of gray shading for extensions decades ago, and it is still the best method, although no longer widely used. Sidebars for manual changes would also be welcome.

A little-understood feature of the RM compiler is its more complete implementation of the IEEE 754 floating-point standard. Specifically, that overflow and divide-by-0 generate special machine represen tations of infinity, and subsequent operations with these infinities obey traditional mathematical conventions. Operations with no mathematical interpretation, such as the real square root of a negative number, produce the value Not-a-Number (NaN). NaNs propagate if used in arithmetic expressions, but comparisons involving NaNs always return false. Although no standardized language makes explicit provision for NaNs, it is not difficult to take advantage of their existence without generating new syntactic structures. The following paragraphs show how simple it is to add NaN support without modifying

FORTRAN.

To test if x is NaN, use the construct:

```
if( x.ne.x ) then . . .
```

because only NaN is not equal to itself. As an example, consider an iterative algorithm to find the minimum of a function. If any step fails to improve the objective function or gives an undefined result, it is usual to reduce the step length but still search in the same direction. The code fragment:

```
if( .not. new .lt. old ) then
     reduce step and repeat
```

accomplishes this neatly for an IEEE-conforming processor and uses no syntactic structures not required by the language standard itself. The otherwise equivalent code:

```
if( new .ge. old ) then
    reduce step and repeat
```

takes the wrong turn if *new* is NaN. The first fragment is still portable to a processor not supporting IEEE 754 arithmetic, although it's obviously not so robust on such machines.

The MS compiler documentation claims full support for NaNs, but this has not been present in a production version of the compiler since Version 3.2 was retired. Lahey also claims this ability, but the transcendental functions terminated on NaNs, rendering the option of little use.

Returning to our list of suggestions, optimization control is another area that needs some work. Ideally, optimization should always yield correct results. If the advantages of using a speedy but not always correct optimization are deemed significant, vendors should provide several optimization levels with risky optimizations clearly identified by higher levels. There should always be some levels that generate correct results for all cases.

The Lahey compiler includes good facilities for porting nonstandard code from mainframe environments. These include subtle issues such as relatively good immunity to type errors in subroutine interfaces and protection of constant arguments from modification in addition to extensions such as *NAMELIST*.

The Prospero and MS compilers come with the source code for their start-up functions and can be used to program for embedded systems. Prospero documents how to use the code, and its product also in-

Figure 2. Testing the compilers—*Test 4 continued*

EXE size (packed)	48.60 K	45.38 K	*35.50 K	46.50 K	-
Correct	*100%	*100%	*100%	*100%	*100%
Exec time	186.39 s	127.04 s	223.93 s	*120.56 s	412.00 s

* *winner in this area*
** *second in this area*

Test 5: PC/AT 8/5.33-MHz 80286/80287. Finding complex roots of real polynomials. ZROOT and LAGUER from numerical recipes, single precision, no I/O, number crunching only. Test for 30th-order solution of $x^{30} + 2x^{29} \ldots + 31$. Although 30th order is pushing single precision, this is a well-behaved polynomial and almost every product could do it.

	Lahey	MS	Pros	RM	WATCOM
Compile time	**14.40 s	44.00 s	19.87 s	28.95 s	*4.83 s
Link time	*10.16 s	15.93 s	28.34 s	17.41 s	-
EXE size (packed)	39.83 K	36.37 K	*25.50 K	35.96 K	-
Correct	*100%	*100%	*100%	-	*100%
Exec time	*8.68 s	10.32 s	14.17 s	failed	12.01 s

* *winner in this area*
** *second in this area*

Note:
RM FORTRAN compiled LAGUER.FOR subroutine incorrectly with optimizer on. Optimizer turned off to obtain a 9.335 time.

Test 6: PC/AT 8/5.33-MHz 80286/80287. Milstandard Standard Coding Test, a superset of ANSI 77 FORTRAN with long variable names and underscore in character set. Program is an osculating to mean orbital mechanics problem based on J2 expansion in Delaunay coordinates. It is double-precision intensive and loops over five of the six coordinates, performing iteration checks at 378 different Delaunay coordinates.

	Lahey	MS	Pros	RM	WATCOM
Compile time	*62.13 s	165.27 s	don't allow long names		
Link time	*11.70 s	15.93 s	or "_"		
EXE size (packed)	48.91 K	*42.59 K			
Correct	*100%	*100%			
Exec time	*56.74 s	64.80 s			

* *winner in this area*

Note:
Code contained LOGICAL*2 variables, which Lahey FORTRAN does not support. They were changed to LOGICAL*4 for Lahey runs.

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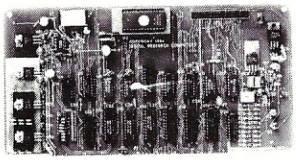

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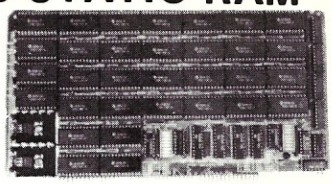

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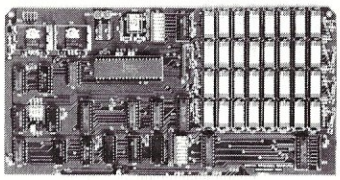

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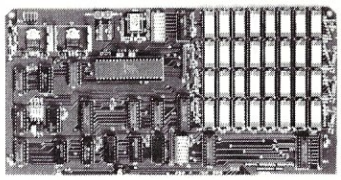

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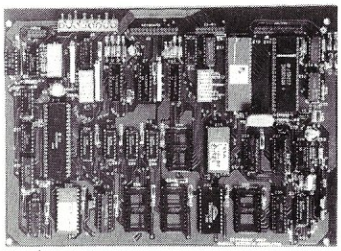

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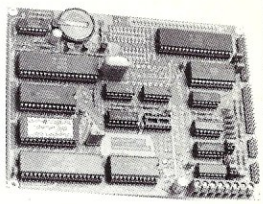

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Figure 3. Execution benchmarks across other machines

	S-Whets kW/s	D-Whets kW/s	REMEZ secs	SVD50x50 secs	30 Roots secs	Price/user x # users
• 6-MHz Z80 + 4511 + 9512	32.6K	8.7K	262.	qc	29.2	
• IBM PC 4.77/4.77	57.8K	52.5K	31.26	264.35	13.74	$3000 x 1
• IBM PC/AT 6/4	98.0K	89.0K	26.66	170.31	13.91	
• AT & T 8-MHz 8086/87	120.6K	111.1K	16.5	130.20	7.30	
• IBM PC/AT 8/5.33	133.2K	121.4K	19.89	127.04	10.32	$5000 x 1
• AT 10/6.67 MHz	165.0K	151.7K	15.81	101.11	8.23	$3500 x 1
• AT 8/10 MHz	169.4K	153.7K	14.38	99.36	7.41	$3500 x 1
• 12-MHz 8086/8087 NS	180.9K	166.6K	11.0	86.8	4.86	
• 386 16M/8 MHz 80287	241.1K	219.2K	11.86	71.76	6.31	$6000 x 1
• 386 16M/16 80387	529.0K	471.0K	3.9	27.35	2.2	$7000 x 1
• Prodigy 4 MAC	528.0K	485.0K	3.0	qc	2.45	$7000 x 1
• MicroVAX II	880.0K	655.0K	2.65	13.56	1.03	
• VAX 11/780 FPA	1191.0K	734.0K	3.0	nr	nr	$ x 20
• 20-MHz Definicon	1167.0K	1054. K	2.4	14.56	4.4	
• 25-MHz Sun 3/260	1261.0K	1208.0K	1.86	9.17	qc	
• VAX 11/785 FPA	1800.0K	1157.0K	1.3	7.9	0.399	$ x 30
• IBM RT/PC APCFPA	2985.0K	2797.0K	1.	8.	qc	
• 25-MHz Sun 3/260 FPA	3561.0K	2373.0K	.65	2.21	.68	
• VAX 8650 FPA	6100.0K	3895.0K	0.53	2.2	0.130	$ 9K x 60
• IBM 3081D	5850.0K	5680.0K	0.30	nr	nr	
• IBM 3090	18000.0K	15000.0K	0.05	0.099	<0.01	$ 50K x 100

Notes

nr	=	*benchmarks not run because machine not available*
qc	=	*questionable code, see note 5 on general benchmark comments*
S/D-Whet	=	*single/double-precision Whetstones. PCs used MS 4.0 FORTRAN, INTEGER*4, huge model /AH switch*
4.77/4.77	=	*4.77 8088 CPU and 4.77-MHz 8087*
6/4	=	*6.0-MHz 80286 and 4.0-MHz 80287*
NS	=	*number smasher board, PC add-on, scaled from 8 and 9.54 MHz*
Z80	=	*upgraded H89 with 1-Mbyte RAM, bank-switched software and modified F80 library (Dr. L. Wittwer, Arlington, Va.)*
MAC	=	*MS/ABSOFT FORTRAN with Prodigy 4 upgrade (16-MHz 68020 and 68881); equivalent to Mac II*
386PC	=	*Compaq 386 with fast hard disk (typically 3:1 compile time improvement; slow 287 did not help floating-point work)*
80386/80387	=	*Hummingboard with 16-MHz 80386 and 10-MHz 80387*
Definicon	=	*20-MHz 68020/68881 using Silicon Valley FORTRAN PC/AT card**
Sun 3/260	=	*25-MHz 68020 with 20-MHz 68881 and FPA Weitek chip set*
IBM RT/PC	=	*April 87 hardware upgrades: RT/PC APC using 16-MHz CMOS, M68881, AFPA Analog Devices 3210,3220 accelerator, and UNIX F77 compiler front-end, in-line option enabled (benchmarks performed by IBM)*
DEC	=	*most current DEC 88xx series; 88xx has same performance as 86xx but is cheaper.*
price/user	=	*price/user for 20 Mbytes storage/user, 1-Mbyte RAM, graphics with IBM giving IBM prices and other PCs listing typical clone prices*
# users	=	*average number of users*

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cludes the ability to request memory allocations at run time. A program that can use all available memory without requiring any particular amount (like most good editors) is much more flexible than the kind that must be recompiled to match each change in the amount of available memory.

One of the authors of UNIX said that "the record is a concept that fills a much needed gap." Each of these compilers has a "feature" that might more properly be characterized as a design error. As much as we like these products, we feel compelled to mention the silly *$INCLUDE* and *C$INCLUDE* statements provided in the MS and WATCOM compilers. These should be supplemented with the industry standard. WATCOM also needs to allow arbitrary record lengths instead of requiring a record-length declaration as part of the file-naming convention or compiler configuration step.

The Microsoft CodeView debugger, with its split-screen operation (and more), is really special. It can break on assembly-language points, and 8087 debugging is also possible. Incredibly, it does not hinder interrupt-driven programming in FORTRAN. On the other hand, the current implementation limits the size of the program you can debug.

Finally, vendors should maintain a strong beta-test policy and actively collect programs and bug reports that can be used to test each language feature with "real code." Because certification can only guarantee that each feature works in isolation, it must always be augmented by real code. Over the years, DEC has collected all important bug reports and turned them into a thorough test suite.

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Conclusions and Recommendations

Which product should you buy? If you can afford only one, the Lahey and Prospero compilers offer good performance at compile with reasonable run time and are probably the best for development work. Lahey's is the only one with *NAMELIST*, and based on this small sample of benchmarks, it is the most robust compiler tested. On the other hand, it does not handle several of the more obscure ANSI suite tests (allowing variables names such as *IF*, allowing you to jump to a numeric label on an *END IF* statement, and so on). Prospero has begun shipping Version 1.2 of their compiler. Among other improvements, are long variable names with underscores and trailing line comments.

If you can afford two, combining the WATCOM compiler with either the MS or RM compiler can give a powerful combination. Develop, debug, and test at high speed with WATCOM and convert to MS or RM for production code. WATCOM doesn't handle overlays, so this option won't work for very large programs. Nevertheless, experience working in a dual-compiler environment is a good one. It certainly improves code portability. Besides, good engineering practice is to repeat critical calculations using two different methods.

The choice between MS and RM FORTRANs is difficult and is a matter of features. RM is probably a bit better for FORTRAN-only work and NaN detection, but MS is better for CodeView, systems work, and interlanguage links.

Acknowledgments, Disclaimers, Misc.

We would like to acknowledge all the hard work that goes into writing a compiler. You must use a compiler on several projects (developing new code and porting code), to fully evaluate it. All products have bugs. Considering the overall quality of all these products, there is not enough

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time to track down which one is the absolute best for all applications and which is the most bug-free.

The distribution disks of MS 4.0 FORTRAN contain a double-precision Whetstone benchmark supplied by A. Tetewsky. Unfortunately, Microsoft used an old version and altered it without noting this. Note that the program gives unreliable timings unless used properly, although the actual Whetstone computation is correct. Microsoft has promised to include the correct Whetstone test on FORTRAN 4.01.

If you send a disk with return postage to A. Tetewsky, he will send you corrected versions of SWHET3 and DWHET3 that report back timing variances and settings that work across all systems.

Special thanks to Dept. 40 of CSDL for use of its 3090 and VAX computers. Thanks to the following for performing the indicated benchmarks: P. Zarchen (Prodigy 4), A. G. W. Cameron (Sun Workstation), Jim Cronin (Definicon Board), and IBM-Austin (RT).

The opinions expressed in this article represent the authors' views only and not those of their employers. §

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Avram Tetewsky is a signal-processing analyst at the Charles Stark Draper Laboratory, 555 Technolgy Sq., Cambridge, MA 02139. He holds an M.S.E.E. from MIT, B.S.E.E. from RPI, an FCC Radio/Telephone License, and an Intern NY State EE License.

Dan Feenberg is an economist at the National Bureau of Economic Research, 1050 Mass Ave., Cambridge, MA 02138. He holds a Ph.D. in Economics from Princetown University and publishes chiefly on topics in public finance. He also moderates the Byte Bix FORTRAN conference.

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Program Interfacing to Microsoft Windows

by William Wong

Part V—Putting Text & Graphics In a Window

This series of articles has a twofold purpose. First, its intent is to give readers considering purchasing the Microsoft Windows Toolkit and writing a windows application an insight into what is involved. Its second purpose is to help readers who have purchased the Toolkit or attended a Microsoft Windows seminar to write a typical application. Some sample programs will be provided after sufficient groundwork has been laid.

We are now ready to put some text and graphics in a window. The previous parts of this article have been a preparation for the enhanced version of the TOGGLE program. This part covers the new functions used by TOGGLE. As you will see, there is very little difference between a tiled and a pop-up window in terms of program support—in fact, the *new_window* and *WndMain* functions do not change.

Rectangles and Regions

Rectangles can be a drawing or a description of an area. This section discusses the *RECTANGLE* data type, which is used within many other objects, including a region. A rectangle is a structure with x and y positions along with a length and width. There is no inherent coordinate system, so a rectangular area is context sensitive. I have used the device coordinate system for windows thus far, but you can also use logical coordinates within a viewport (discussed later) and various orientations for these coordinate systems. A rectangle is also used to describe a region.

A region is something that is available to programmers but that is used primarily by Windows. A simple region is either a rectangle or an elliptical area defined by its bounding rectangle. Regions can be combined and can also include complex polygons, which cover most objects that Windows can build. Regions are useful in describing the window areas being viewed and hidden. Regions can be used by an application, too—for example, a CAD program could keep track of text using bounding rectangles and "greek" the text (that is, display the text as a box) if the text would be too small to seen on the screen.

A region is a special Windows object that must be referenced by a handle. It must also be created and deleted. Figure 1 lists the region functions that Windows provides. *CombineRgn* combines two regions into a third, whose contents are updated, based upon the value of *CombineMode*—for example, *RGN_AND*. The result of the function is *NULLREGION*, *SIMPLEREGION*, *COMPLEXREGION*, or *ERROR*. The *OffsetRgn* function is used to logically move an entire region whereas *PtInRegion* checks to see if a particular position is within a region. Regions can be compared for equality using *EqualRgn*. The other functions are used to create new regions. Rotation of a region is not supported.

Device Contexts and Paint Structures

A device context describes a drawing area associated with a particular device along with a number of objects that can be used to draw in the drawing area. The device context is an internal Windows object referenced by a handle. This handle is necessary to do any type of drawing. A device context must be set up prior to its use, and this is often done by Windows—such as when a portion of a window needs to be redrawn. The device context is then passed as a parameter of a message.

A specific device is accessed using *CreateDC* (Figure 2). The pointers reference strings for the device driver file name (without file extension or path), the logical device name, the physical output device name, and any device-specific initialization string that may be necessary. By convention, a *NULL* handle indicates failure. Only a fixed number of device contexts are available. You use the *CreateIC* function to obtain information about a device. Information contexts are like device contexts, but you cannot draw with them. *CreateCompatibleDC* makes a memory-based device context that mimics a device-specific context such as a screen or a printer, which is useful for creating drawings that can be transferred to a real device. Device context objects must be deleted using *DeleteDC* when they are no longer needed. Deleted objects are returned to a common resource pool. A quick way to save and restore the state of a device context is to use *SaveDC* and *RestoreDC*.

The state of a device context is changed by drawing or by replacing one of its objects using *SelectObject*. *SelectObject* knows the type of *hObject* and uses it to replace the corresponding object in a device context. A device context contains one copy of each of the following objects: pen, brush, font, bit map, and re-

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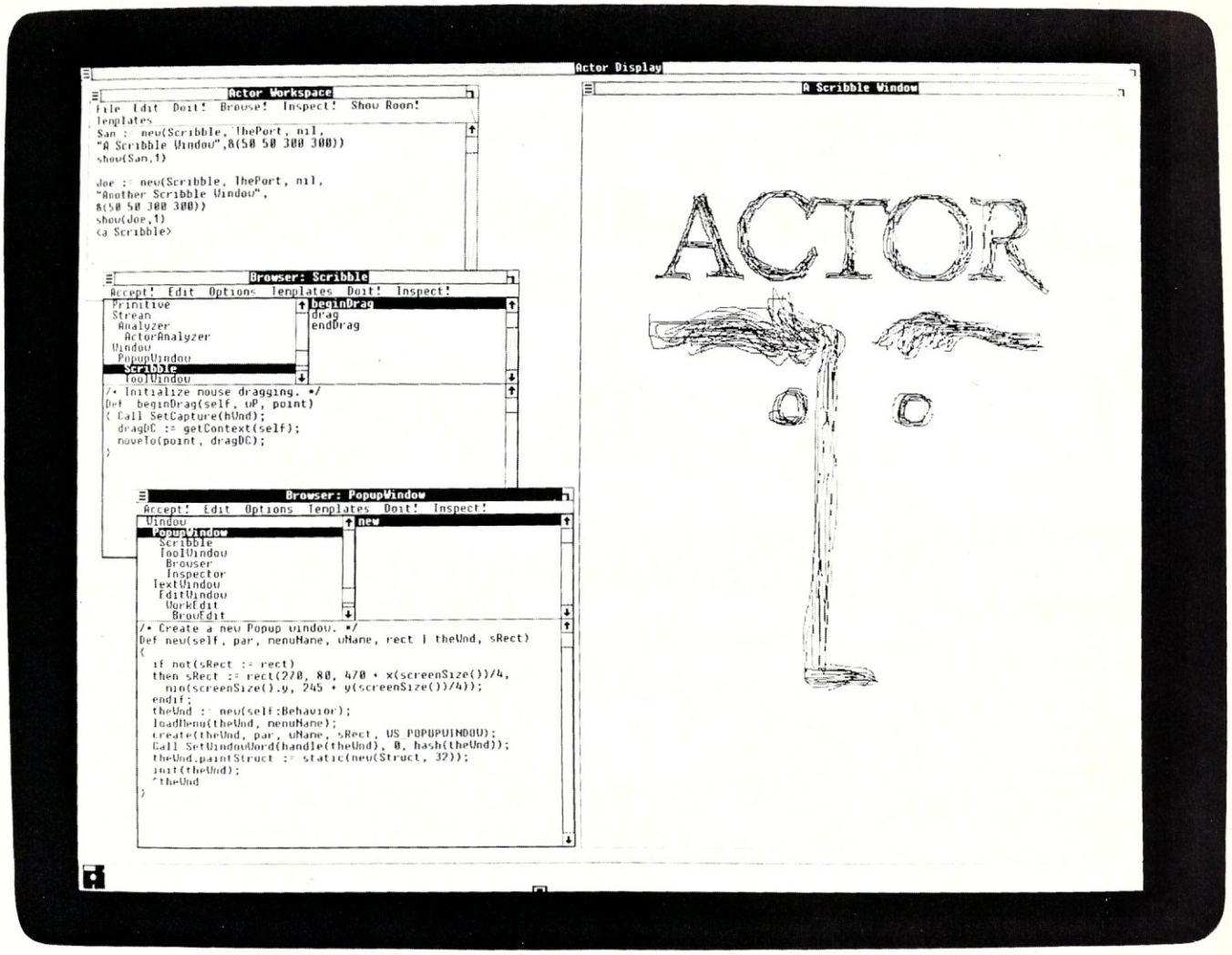

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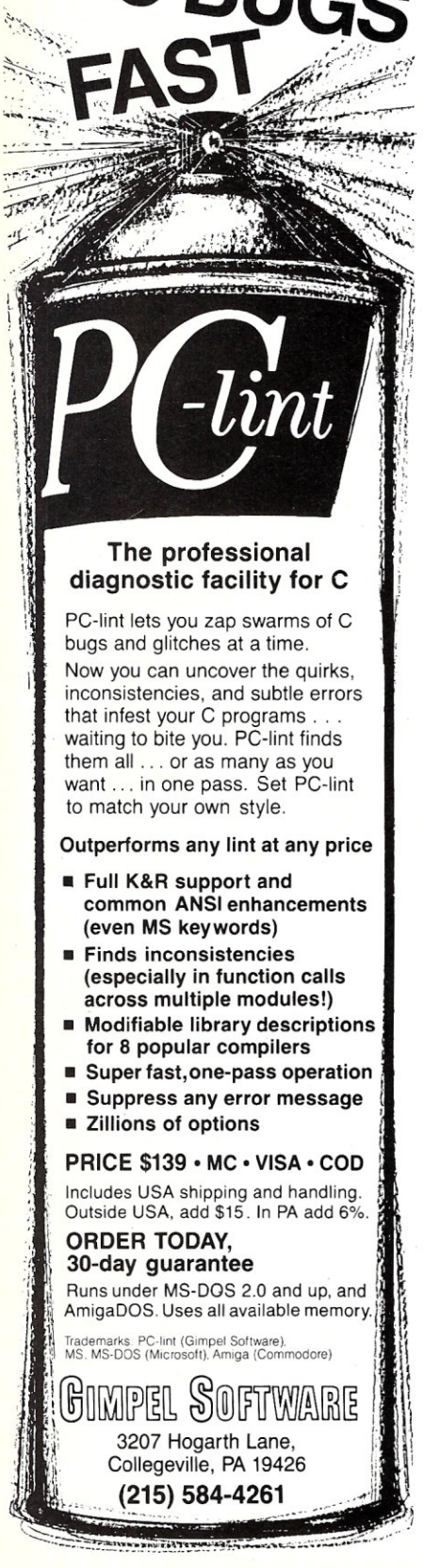

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Figure 1. Rectangle and region functions

```
short   CombineRgn ( hDestRgn, hSrcRgn1, hSrcRgn2, CombineMode )
short   OffsetRgn  ( hRgn, nX, nY )
BOOL    PtInRegion ( hRgn, nX, nY )
BOOL    EqualRgn   ( hRgn1, hRgn2 )
HANDLE  CreateRectRgn             ( nX1, nY1, nX2, nY2 )
HANDLE  CreateRectRgnIndirect     ( lpRect )
HANDLE  CreateEllipticRgn         ( nX1, nY1, nX2, nY2 )
HANDLE  CreateEllipticRgnIndirect ( lpRect )
HANDLE  CreatePolygonRgn          ( lpPoints, nCount, nPolyFillMode )
```

Figure 2. Device context functions and paint structures

```
HANDLE CreateDC  ( lpDriverName, lpDeviceName, lpOutput, lpInitData )
HANDLE CreateIC  ( lpDriverName, lpDeviceName, lpOutput, lpInitData )
HANDLE CreateCompatibleDC ( hDC )
BOOL   DeleteDC      ( hDC )
short  SaveDC        ( hDC )
BOOL   RestoreDC     ( hDC, nSavedDC )
HANDLE SelectObject  ( hDC, hObject )
short  SelectClipRgn ( hDC, hRgn )
short  GetObject     ( hObject, nCount, lpObject )
```

Figure 3. Data structures

```
typedef struct
  {
    WORD  lopnStyle ;
    POINT lopnWidth ;
    DWORD lopnColor ;
  }
  LOGPEN ;

typedef struct
  {
    WORD  lbStyle ;
    DWORD lbColor ;
    short lbHatch ;
  }
  LOGBRUSH ;

typedef struct
  {
    short tmHeight ;
    short tmAscent ;
    short tmDescent ;
    short tmInternalLeading ;
    short tmExternalLeading ;
    short tmAveCharWidth ;
    short tmMaxCharWidth ;
    short tmWeight ;
    BYTE  tmItalic ;
    BYTE  tmUnderlined ;
    BYTE  tmStruckOut ;
    BYTE  tmFirstChar ;
    BYTE  tmLastChar ;
    BYTE  tmDefaultChar ;
```

```
    BYTE  tmBreakChar ;
    BYTE  tmPitchAndFamily ;
    BYTE  tmCharSet ;
    short tmOverhang ;
    short tmDigitizedAspectX ;
    short tmDigitizedAspectY ;
  }
  TEXTMETRIC ;

typedef struct
  {
    HDC  hdc ;
    BOOL fErase ;
    RECT rcPaint ;
    BOOL fRestore ;
    BOOL fIncUpdate ;
    BYTE rgbReserved [ 16 ] ;
  }
sa
  PAINTSTRUCT ;

typedef struct
  {
    short lfHeight ;
    short lfWidth ;
    short lfEscapement ;
    short lfOrientation ;
    short lfWeight ;
    BYTE  lfItalic ;
    BYTE  lfUnderline ;
    BYTE  lfStrikeOut ;
    BYTE  lfCharSet ;
    BYTE  lfOutPrecision ;
    BYTE  lfClipPrecision ;
    BYTE  lfQuality ;
    BYTE  lfPitchAndFamily ;
    BYTE  lfFaceName [ LF_FACESIZE ] ;
  }
  LOGFONT ;
```

Figure 4a. Device context utility functions (drawing with *ViewPorts*)

```
RGB    SetBkColor ( hDC, rgbColor )
RGB    GetBkColor ( hDC )
short  SetBkMode    ( hDC, nBkMode )
short  GetBkMode    ( hDC )
RGB    SetTextColor ( hDC, rgbColor )
RGB    GetTextColor ( hDC )
short  SetMapMode   ( hDC, nMapMode )
short  GetMapMode   ( hDC )
short  SetROP2      ( hDC, nDrawMode )
short  GetROP2      ( hDC )
short  SetStretchBltMode ( hDC, nStretchMode )
short  GetStretchBltMode ( hDC )
short  SetPolyFillMode   ( hDC, nPolyFillMode )
short  GetPolyFillMode   ( hDC )
```

gion. The currently assigned object is used by drawing functions.

Device contexts are often referenced through paint structures (Figure 3). The *fErase* flag is true if the background should be erased before drawing. The area to paint is specified by *rcPaint* and the remaining elements are reserved by Windows.

Drawing with ViewPorts

Figure 4a lists some of the device context utility functions that can be used to set or get related drawing attributes. Background color is the default used to erase areas when a window is being redrawn. Background mode can be *TRANSPARENT* or *OPAQUE*. Text color is the foreground color for text. *SetMapMode* indicates how points are to be mapped from their logical position to a point on the specific device.

Values of *nMapMode* are listed in Figure 4b. *MM_ISOTROPIC* is the typical mode for screens. The metric and English units are normally used with plotters and possibly printers. *MM_ISOTROPIC* and *MM_ANISOTROPIC* require that a viewport be specified before any drawing occurs. Other mode functions include *SetROP2* to specify the raster operation mode (*R2_COPYPEN*, *R2_XORPEN*, and so on), *SetStretchBltMode* (can be *WHITEONBLACK*, *BLACKONWHITE*, or *COLORONCOLOR*), and *SetPolyFillMode* (can be *ALTERNATE* or *WINDING*). These attributes are used by the various drawing functions.

Windows are described in device coordinates with a fixed axis. The client area of a window is mapped based upon the window and viewport settings set using functions listed in Figure 4c. The window functions place the client area on a physical area on the screen. The physical client coordinates are based about the origin, and the size and placement of the drawing rectangle are based upon the extent. Negative extent values indicate that the drawing rectangle is to the left if x is negative and up if y is negative.

The viewport origin and extent are then used to map logical coordinates to the physical client coordinates. This gives a two-level mapping system that can be used to make the actual drawing independent of the device.

A drawing will be stretched if either the window or viewport extents are changed. There are two mapping operations because

WRITING WINDOWS APPLICATIONS

Windows applications cannot be written in MASM or C alone. This is because the linker must understand Windows objects (for example, icons, dialog boxes) and linking to Windows is through a special call linkage, not an INT *instruction.*

To write a windows application program, you need the Windows Toolkit ($500 list, but discounted to as little as $309) and the latest version of either Microsoft C, MASM, or Pascal. Microsoft conducts seminars for windows application programmers at which the Windows Toolkit package is distributed. Programmers who buy the Toolkit without attending the seminars are handicapped because the manuals contain little theory. This series of articles should assist programmers who buy the Toolkit without attending the seminars to write Windows application programs. It should also help seminar attendees.

The Whitewater Group (Technology Innovation Center, 906 University Pl., Evanston, IL 60201; (312) 491-2370) has introduced Actor, a lower-cost alternative to the Microsoft Windows Toolkit. Its documentation is poorer than that of the Toolkit, however, because it deals primarily with the Actor programming language.

all the points in either coordinate system are integers. Arbitrary scaling can occur only by using a ratio because floating-point numbers are not used. The scale functions are used to adjust the existing settings in a similar fashion. Note, that the numerator is multiplied by the current setting before being divided by the denominator to retain accuracy.

The offset functions move a window or viewport origin without having to get the current value and set a new value.

Brushes, Pens, and Fonts

Drawing objects in a device context are referenced by a handle and used by specific functions—for example, a line only uses the pen object whereas a rectangle uses the pen for the outline and the brush for the fill characteristics. In general, a pen is used for lines and outlines, the brush is used for interior areas, and fonts are used for text.

Windows includes several objects with default characteristics that can be obtained using *GetStockObject* (Figure 5a), where *nStockObjectIndex* is specified as shown in Figure 5b. They can be used freely by an application and need not be allocated and deallocated, as are normal application-specific objects. Likewise, objects can be referenced by multiple device contexts, so a duplicate pen does not have to be made by an application with multiple device contexts. Changing the characteristics of the pen affects every one of the contexts using the object, however. *DeleteObject* removes objects that are no longer needed.

The *CreateX* functions are used to make new objects with arbitrary characteristics, and the *CreateXIndirect* functions make new objects based upon a complete description of the object. The data structures referred to by these functions are listed in Figure 6. The enumeration of all the valid values is beyond the scope of this article and can be found in the Windows Toolkit. Most of the element names indicate the general purpose of the field.

Essentially, pens have a color, thickness, and style, such as solid or dotted, whereas a brush has a color and hatch pattern, such as *HS_FDIAGONAL*. Bit maps are rectangular areas that can be used for drawing or copied to and from a window. Fonts are used for text output. They can have fixed or proportional spacing along with a host of other attributes that can be selected. The availability of a particular font depends upon the device and what fonts have been installed.

Figure 4b. *nMapMode* values

Value	Logical Unit
MM_TEXT	Maps to physical unit
MM_LOMETRIC	Maps to 0.1 mm
MM_HIMETRIC	Maps to 0.01 mm
MM_LOENGLISH	Maps to 0.01 inches
MM_HIENGLISH	Maps to 0.001 inches
MM_TWIPS	Maps to 1/1440 inches
MM_ISOTROPIC	Scales using equally scaled axes
MM_ANISOTROPIC	Scales using independently scaled axes

Figure 4c. Window and viewport functions

```
POINT   SetWindowOrg    ( hDC, nX, nY )
POINT   GetWindowOrg    ( hDC )
POINT   SetWindowExt    ( hDC, nX, nY )
POINT   GetWindowExt    ( hDC )

POINT   SetViewportOrg  ( hDC, nX, nY )
POINT   GetViewportOrg  ( hDC )
POINT   SetViewportExt  ( hDC, nX, nY )
POINT   GetViewportExt  ( hDC )

POINT   ScaleWindowExt    ( hDC, nXnum, nXdenom, nYnum, nYdenom )
POINT   ScaleViewportExt  ( hDC, nXnum, nXdenom, nYnum, nYdenom )

POINT   OffsetWindowOrg   ( hDC, nX, nY )
POINT   OffsetViewportOrg ( hDC, nX, nY )
```

Figure 5a. Object functions (brushes, pens, and fonts)

```
HANDLE GetStockObject ( nStockObjectIndex )
BOOL   DeleteObject   ( hObject )

HANDLE CreatePen         ( nPenStyle, nWidth, rgbColor )
HANDLE CreatePenIndirect ( lpLogPen )

HANDLE CreateSolidBrush    ( rgbColor )
HANDLE CreateHatchBrush    ( nHatch, rgbColor )
HANDLE CreatePatternBrush  ( hBitmap )
HANDLE CreateBrushIndirect ( lpLogBrush )

HANDLE CreateBitmap           ( nWidth, nHeight,
                                nPlanes, nBitCount, lpBits )
HANDLE CreateBitmapIndirect   ( lpBitmap )
HANDLE CreateCompatibleBitmap ( hDC, nWidth, nHeight )

HANDLE CreateFont ( nHeight, nWidth, nEscapement, nOrientation,
                    nWeight,
                   cItalic, cUnderline, cStrikeOut,
                   nCharSet, nOutputPrecision, nClipPrecision,
                   cQuality, cPitchAndFamily,
                   lpFaceName )
HANDLE CreatFontIndirect ( lpLogFont )
```

Figure 5b. *nStockObjectIndex* values

```
WHITE_BRUSH         WHITE_PEN       ANSI_FIXED_FONT
LTGRAY_BRUSH        BLACK_PEN       OEM_FIXED_FONT
GRAY_BRUSH          NULL_PEN        ANSI_VAR_FONT
DKGRAY_BRUSH                        SYSTEM_FONT
BLACK_BRUSH                         DEVICE_DEFAULT_FONT
HOLLOW_BRUSH
NULL_BRUSH
```

Figure 6. Drawing functions (drawing in a window)

```
short SetRelAbs ( hDC, nRelAbsMode )
short GetRelAbs ( hDC )

POINT GetCurrentPosition ( hDC )
VOID  MoveTo      ( hDC, nX, nY )
BOOL  LineTo      ( hDC, nX, nY )

BOOL  Polyline    ( hDC, lpPoints, nCount )
BOOL  Polygon     ( hDC, lpPoints, nCount )
BOOL  Rectangle   ( hDC, nX1, nY1, nX2, nY2 )
BOOL  RoundRect   ( hDC, nX1, nY1, nX2, nY2 )

BOOL  Ellipse     ( hDC, nX1, nY1, nX2, nY2 )
BOOL  Arc         ( hDC, nXL, nYL, nXR, nYR, nXB, nYB, nXE, nYE )
BOOL  Pie         ( hDC, nXL, nYL, nXR, nYR, nXB, nYB, nXE, nYE )

BOOL  PatBlt      ( hDC, nX, nY, nWidth, nHeight, dwRop )
BOOL  BitBlt      ( hDestDC, nXD, nYD, nWidth, nHeight,
                    hSrcDC,  nXS, nYS, dwRop )
BOOL  StretchBlt  ( hDestDC, nXD, nYD, nWidthD, nHeightD,
                    hSrcDC,  nXS, nYS, nWidthS, nHeightS, dwRop )

BOOL  DrawIcon    ( hDC, nX, nY, hIcon )

RGB   SetPixel    ( hDC, nX, nY, rgbColor )
RGB   GetPixel    ( hDC, nX, nY )
BOOL  FloodFill   ( hDC, nX, nY, rgbColor )
BOOL  FillRgn     ( hDC, hRgn, hBrush )
BOOL  PaintRgn    ( hDC, hRgn )
BOOL  FrameRgn    ( hDC, hRgn, hBrush, nWidth, nHeight )
BOOL  InvertRgn   ( hDC, hRgn )

VOID  FillRect    ( hDC, lpRect, hBrush )
VOID  FrameRect   ( hDC, lpRect, hBrush )
VOID  InvertRect  ( hDC, lpRect )
```

Figure 7. Functions for text in a window

```
BOOL TextOut     ( hDC, nX, nY, lpString, nCount )
VOID DrawText    ( hDC, lpString, nCount, lpRect, wFormat )
BOOL GreyString  ( hDC, hBrush, lpOutputFunc, lpData,
                   nCount, nX, nY, nWidth, nHeight )
```

Drawing in a Window

Drawing in a window is actually the simplest function described thus far because most of the parameters for drawing are contained in the device context. The functions covered in this section are listed in Figure 6.

There are two types of drawing functions. One set uses the graphic cursor associated with each device context. The other ignores the graphic cursor by supplying all necessary positioning information as parameters.

Positioning of figures can be relative to the viewport origin or the graphic cursor. *SetRelAbs* is used to specify the method used, where *nRelAbsMode* is either *ABSOLUTE* or *RELATIVE*. The previous setting is returned.

The graphic cursor position is set using the *MoveTo* function. The current position can be obtained using the *GetCurrentPosition* function. The other cursor movement is *LineTo*, which draws a line from the current cursor position using the currently installed pen. The new cursor position is the endpoint of the line.

Multiple lines can be drawn using *Polyline*, *Polygon*, *Rectangle*, and *RoundRect*. These do not modify the cursor position but are offset by it if in *RELATIVE* mode. Each use the current pen for the outline. All but *Polyline* use the current brush to fill the interior region. The drawing sequence of lines for *Polygon* are specified by the current *PolyFillMode* (see *SetPolyFillMode* in Figure 4a), which is either *ALTERNATE* or *WINDING*. The latter computes the border based upon all the points whereas the *ALTERNATE* mode uses the points in sequential order.

Circular drawings are done using the *Ellipse*, *Arc*, and *Pie* functions. The *Ellipse* and *Pie* functions utilize the current brush to fill their interior. The parameters of the *Ellipse* function are the bounding box coordinates. A circle is obtained by specifying a square. The *Arc* function only uses the current pen. The starting and ending points are specified by the *Arc* and *Pie* functions.

Bit block transfers (*BitBlt*) functions are used often by Windows and Windows applications. Three *Blt* functions are provided by Windows. *PatBlt* uses the current brush to cover a rectangular area. *BitBlt* moves one rectangular area to another. The source and destination device context are often the same but can be different. Windows converts colors if the type of the device contexts differs, as in a monochrome-to-color conversion. In this case, the background color replaces black and

the foreground color is white. *StretchBlt* is used when the size of the source rectangle is different from that of the destination. The *SetStretchBltMode* (Figure 4a) is used by *StretchBlt* to determine how extra lines are added. Drawing icons are a common form of *BitBlt*, hence the *DrawIcon* function. Individual pixels can be manipulated using the *SetPixel* and *GetPixel* functions.

Areas can be filled using several functions. *FloodFill* starts from a designated point and fills using a specific color until the color is encountered. *FillRgn* fills areas specified by a region of any type using a specified brush. *PaintRgn* is the same but uses the brush in the device context. Frames are normally done using the current pen, but *FrameRgn* uses the specified brush of the specified size. The same set of operations can be performed on simple rectangles using the corresponding functions. The *InvertRgn* and *InvertRect* functions invert the colors in the specified areas. Inverting the same region a second time restores the region to its original state.

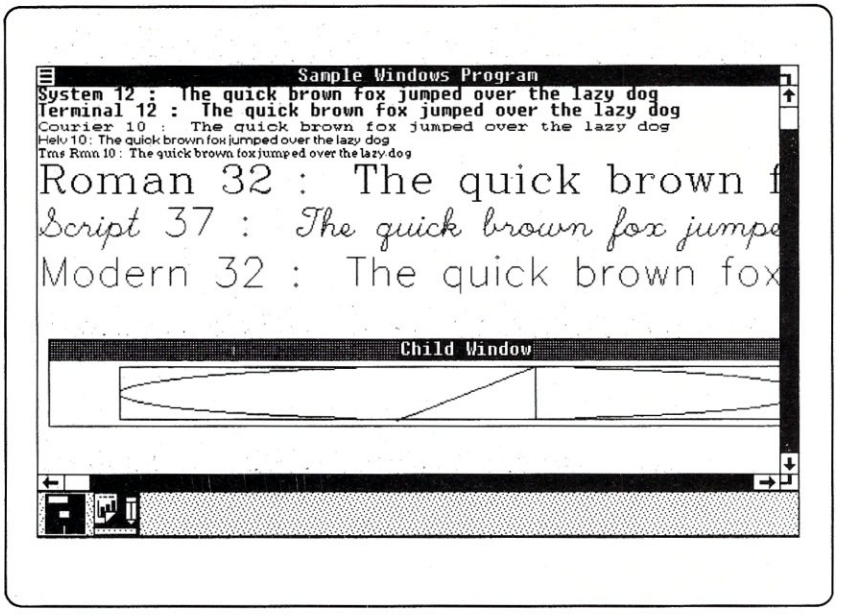
Text in a Window

Windows has few text-drawing functions, and there is nothing akin to support for a scrolling terminal or text cursor. All this must be done using the caret and *BitBlt* functions.

TextOut is the simplest text-output function (Figure 7). It specifies a position and uses the current font. Text is drawn on a single line and clipped in just the same way as is graphics. The *DrawText* function allows a bit more formatting to occur. The position and limits of the text are specified by the *lpRect* parameter. The *wFormat* parameter indicates how the text is placed into the rectangle. Justification, tabs, word wrap, and multiple lines are some options. The *DrawText* function can also be used to center text such as that found in buttons.

The *GreyString* function is used to display a string using a brush so various patterns can be used as well as lighter than normal text. The position for the text output is specified in the last four parameters. The text string is normally referenced using *lpData*, although this can be an arbitrary data structure that is passed to *lpOutputFunc*. *TextOut* is used if *lpOutputFunc* is *NULL*. The *lpOutputFunc* parameters are the same as those of *TextOut*. The *TextOut*, *lpString*, and *nCount* parameters come from the *lpData* and *nCount* parameters of *GreyString*. The difference is the *hDC* parameter. *GreyString* creates a memory device context that is passed to

Figure 8. The TOGGLE program, shown here, has been enhanced to have text in the parent window and graphics in the child window.



Program Interfacing to Microsoft Windows-Part V
Listing 1

```
/*  ====  Basic Windows Toggle Program    05-07-87 WGW  ====          */

#include "windows.h"            /* common Windows  definitions        */
#include "string.h"             /* common C string definitions        */
#include "toggle.h"             /* common TOGGLE.EXE definitions      */

#define PRINT_FONT      WM_USER /* first user defined message         */

/* ==============  External Function Definitions  ==============      */
int FAR PASCAL lstrlen ( LPSTR ) ;
void sprintf () ;

/* ===============  Forward Function Definitions  ==============      */
long FAR PASCAL MyWndProc      ( HWND, unsigned, WORD, LONG) ;
long FAR PASCAL MyChildWndProc ( HWND, unsigned, WORD, LONG) ;

/* ===============  Internal Type Definitions  =================      */
typedef struct
  {
    HWND          hWnd ;
    short         y ;
    LPPAINTSTRUCT pps ;
    LPLOGFONT     lpLogFont ;
  }
  PrintFontInfo ;

typedef PrintFontInfo FAR * LPPrintFontInfo ;

/* =============  Internal Global Variable Definitions  =========      */
char    szAppName     [ 10 ] ;
char    szWindowTitle [ 30 ] ;
char    szPopup       [ 20 ] ;
char    szTiled       [ 20 ] ;
char    szChild       [ 20 ] ;

RECT    position ;              /* window position in popup mode      */
```

Finally!

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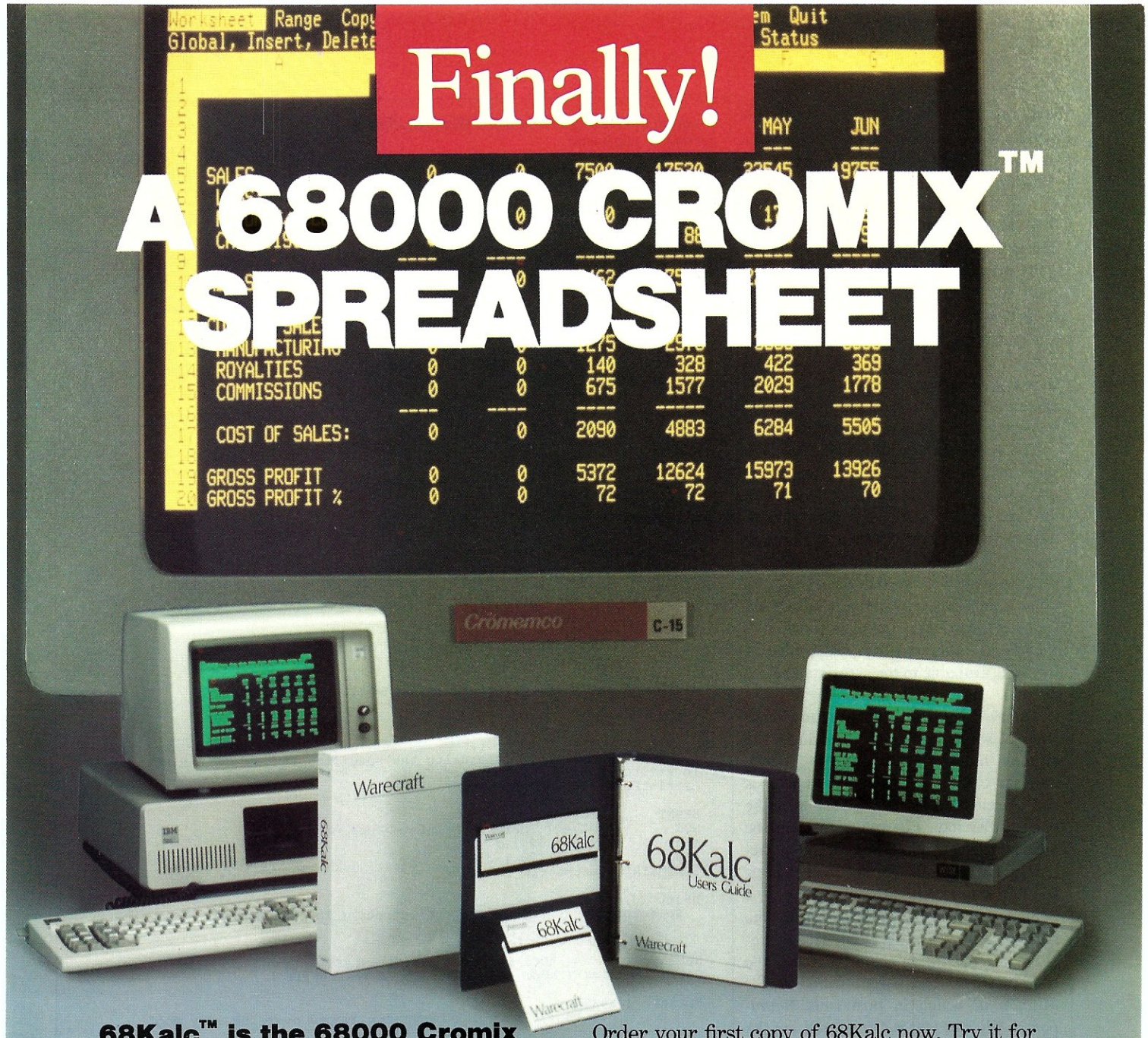

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lpOutputFunc. This function draws the text and then *GreyString* copies the text to the *GreyString* device context after doing a little brushup.

TOGGLE Enhanced

The TOGGLE program (Figure 8), originally presented in the previous issue, has been enhanced to use some of the functions described here (see Listing 1). The string.h file contains definitions for the normal C string functions. The first new item is the constant *PRINT_FONT*. This is a user-defined message number that will be generated within the application.

This version of TOGGLE operates in the same way as the earlier one except that graphic figures are placed in the child window and text is placed in the main window. You can still toggle between pop-up and tiled windows. The text uses the fonts associated with the screen device. The Windows *EnumFonts* function is also used (not described here) to call a function—*PrintFonts*—that passes a description of the fonts available to the associated device context.

The *PrintFontInfo* data structure keeps track of what is going on. It includes the window handle so the *PRINT_FONT* message can be sent. The *y* parameter is the current row in which text is to be placed. *Pps* indicates where text can be printed on the window, and *lpLogFont* refers to the font information so the specified font can be used.

Essentially, TOGGLE is driven by the redraw messages. The child window redraws a fixed figure centered within the child window. The parent window calls *MainPaint*, which in turn calls *EnumFonts*. A line of text is displayed using the enumerated font, and the *y* position is updated so each line appears after the previous line of text.

The *PrintFonts* function uses *SendMessage* to actually print the font. This is an easy way to get back to the proper window so its environment is set up properly. The message turns into a direct subroutine call. The *PrintOneLine* function is called by the main window function when the message is received. Why do this instead of calling *PrintOneLine* directly—to show how to send a message and also to keep the window environment set up properly. The latter can sometimes be difficult.

PrintOneLine saves the old font and sets the enumerated font. The text string is then drawn using *TextOut*. The old font is restored, and the returned object is the new font, which is then deleted.

Program Interfacing to Microsoft Windows-Part V
Listing 1, continued

```
/* ===============  Function Definitions  ================              */
/*                                                                     */
/* ---------  Erase rectangle with background color  ------            */
void EraseRectangle ( hDC, pRect )
  HDC    hDC ;
  LPRECT pRect ;
{
  HBRUSH hbr, hbrOld ;

  /* ------  Erase update rectangle with background color  ------      */
  hbr    = CreateSolidBrush ( GetSysColor (COLOR_WINDOW) ) ;
  hbrOld = (HBRUSH) SelectObject ( hDC, (HANDLE) hbr ) ;
  FillRect      ( hDC, pRect, hbr ) ;
  SelectObject ( hDC,  (HANDLE) hbrOld ) ;
  DeleteObject ( (HANDLE) hbr ) ;
}

/* --------------  Called by EnumFonts  -----------------              */
int FAR PASCAL PrintFonts ( lpLogFont
                          , lpTextMetrics
                          , FontType
                          , lpPrintFontInfo
                          )
  LPLOGFONT       lpLogFont ;
  LPTEXTMETRIC    lpTextMetrics ;
  short           FontType ;
  LPPrintFontInfo lpPrintFontInfo ;
{
  ( lpPrintFontInfo -> lpLogFont ) = lpLogFont ;

  SendMessage ( lpPrintFontInfo -> hWnd
              , PRINT_FONT
              , 0
              , (long) lpPrintFontInfo
              ) ;

  ( lpPrintFontInfo -> y ) += ( lpTextMetrics -> tmHeight ) ;

  return 1 ;
}

/* -----------  Print a line using the specified font  ----------      */
void PrintOneLine ( lpPrintFontInfo )
  LPPrintFontInfo lpPrintFontInfo ;
{
  HFONT      hFontOld ;
  HDC        hDC = ( lpPrintFontInfo -> pps -> hdc ) ;
  char       name [ 32 ] ;
  char       text [ 128 ] ;
  TEXTMETRIC TextMetric ;

  hFontOld =
    SelectObject ( hDC, CreateFontIndirect ( lpPrintFontInfo ->
          lpLogFont )) ;
  GetTextFace    ( hDC, sizeof ( name ), (LPSTR) name ) ;
  GetTextMetrics ( hDC, (LPTEXTMETRIC) & TextMetric ) ;

  sprintf ( text
          , "%s %d :  The quick brown fox jumped over the lazy dog"
          , name
          , TextMetric.tmHeight
          ) ;
  TextOut ( hDC
          , 0
          , lpPrintFontInfo -> y
          , (LPSTR) text
          , (short) lstrlen ((LPSTR) text )
          ) ;
  DeleteObject ( SelectObject ( hDC, hFontOld )) ;
}

/* ----  Paint the work area of the window the background color  ----  */
void MainPai{nt ( hWnd, pps )
  HWND          hWnd ;
  LPPAINTSTRUCT pps ;
{
  PrintFontInfo PrintInfo ;
  HDC           hDC = pps -> hdc ;

  /* -----------  Erase Background if necessary  ------------          */
  if ( pps ->  fErase )                 /* check if erase flag is set  */
    EraseRectangle ( hDC, (LPRECT) & pps ->  rcPaint ) ;
  /* --------------  Write text in window  ------------------          */
  PrintInfo.hWnd = hWnd ;
  PrintInfo.y    = 0 ;
  PrintInfo.pps  = pps ;

  SetBkMode     ( hDC, TRANSPARENT ) ;
  SetTextColor ( hDC, GetSysColor ( COLOR_WINDOWTEXT )) ;
  EnumFonts     ( hDC, (LPSTR) NULL, PrintFonts, (LPSTR) & PrintInfo ) ;
```

```
  SetBkMode     ( hDC, OPAQUE ) ;
}

/* ----  Paint the work area of the window the background color  ----    */
void ChildPaint ( hWnd, pps )
  HWND        hWnd ;
  LPPAINTSTRUCT pps ;
{
  RECT ClientRect ;
  HPEN hpen, hpenOld ;
  HDC  hDC = pps -> hdc ;

  /* ---------  Setup device context for drawing  ---------             */
  SetBkMode      ( hDC, OPAQUE ) ;
  SetROP2        ( hDC, R2_COPYPEN ) ;
  GetClientRect  ( hWnd, (LPRECT) & ClientRect  ) ;
  SetMapMode     ( hDC, MM_ANISOTROPIC ) ;
  SetWindowOrg   ( hDC, -10,  110 ) ;
  SetWindowExt   ( hDC, 120, -120 ) ;
  SetViewportOrg ( hDC, 0, 0 ) ;
  SetViewportExt ( hDC
                 , (short) (ClientRect.right  - ClientRect.left)
                 , (short) (ClientRect.bottom - ClientRect.top)
                 ) ;

  /* ----------  Erase area if necessary  ---------------             */
  if ( pps ->  fErase )                 /* check if erase flag is set   */
    EraseRectangle ( hDC, (LPRECT) & pps ->  rcPaint ) ;

  /* -----------  Setup new drawing pen  ----------------             */
  hpen    = CreatePen ( PS_SOLID, 0, GetSysColor ( COLOR_WINDOWTEXT )) ;
  hpenOld = SelectObject ( hDC, (HANDLE) hpen ) ;
  SelectObject ( hDC, GetStockObject ( NULL_BRUSH )) ;

  /* ----  Do some drawing  ----                                        */
  MoveTo ( hDC, 40,   0 ) ;
  LineTo ( hDC, 60, 100 ) ;
  LineTo ( hDC, 60,   0 ) ;
  Rectangle ( hDC,   0,   0, 100, 100 ) ;
  Ellipse   ( hDC,   0, 100, 100,   0 ) ;

  /* ----  Restore old drawing pen to device context  ----             */
  SelectObject ( hDC, (HANDLE) hpenOld ) ;
  DeleteObject ((HANDLE) hpen ) ;
}

/* ---------------  Initialize program  ------------------             */
/* Return TRUE if an error occurs.                                     */
BOOL MainInit ( hInstance )
  HANDLE hInstance ;
{
  BOOL      result ;
  PWNDCLASS pTypeClass ;

  /* -----  Copy strings from resource section  ----                   */
  LoadString ( hInstance, IDSNAME,    (LPSTR)szAppName,     10 ) ;
  LoadString ( hInstance, IDSTITLE,   (LPSTR)szWindowTitle, 30 ) ;
  LoadString ( hInstance, IDSPOPUP,   (LPSTR)szPopup,       20 ) ;
  LoadString ( hInstance, IDSTILED,   (LPSTR)szTiled,       20 ) ;
  LoadString ( hInstance, IDSCHILD,   (LPSTR)szChild,       20 ) ;

  /* ----  Get buffer area for setup parameters  ----                  */
  pTypeClass =  (PWNDCLASS) LocalAlloc ( LPTR, sizeof (WNDCLASS)) ;

  /* ----  Setup child window class for registry  ----                 */
  pTypeClass ->  hCursor       = LoadCursor ( NULL, IDC_CROSS ) ;
  pTypeClass ->  hIcon         = NULL ;
  pTypeClass ->  lpszMenuName  = (LPSTR) NULL ;
  pTypeClass ->  lpszClassName = (LPSTR) szChild ;
  pTypeClass ->  hbrBackground = (HBRUSH) GetStockObject ( WHITE_BRUSH ) ;
  pTypeClass ->  hInstance     = hInstance ;
  pTypeClass ->  style         = CS_VREDRAW | CS_HREDRAW ;
  pTypeClass ->  lpfnWndProc   = MyChildWndProc ;

  /* ----  Register child window class  ----                           */
  RegisterClass ((LPWNDCLASS) pTypeClass ) ;

  /* ----  Setup window class for registry  ----                       */
  pTypeClass ->  hCursor       = LoadCursor ( NULL, IDC_ARROW ) ;
  pTypeClass ->  hIcon         = LoadIcon ( hInstance,  (LPSTR)szAppName ) ;
  pTypeClass ->  lpszMenuName  = (LPSTR) NULL ;
  pTypeClass ->  lpszClassName = (LPSTR) szAppName ;
  pTypeClass ->  hbrBackground = (HBRUSH) GetStockObject ( WHITE_BRUSH ) ;
  pTypeClass ->  hInstance     = hInstance ;
  pTypeClass ->  style         = CS_VREDRAW | CS_HREDRAW ;
  pTypeClass ->  lpfnWndProc   = MyWndProc ;

  /* ----  Try to register class and then deallocate structure  ----   */
  result = ( ! RegisterClass ((LPWNDCLASS) pTypeClass )) ;
  LocalFree ((HANDLE) pTypeClass ) ;    /* Deallocate structure        */
  return result ;                       /* return initialize flag */
}
```

The *ChildPaint* function sets up a window and viewport along with several other device context parameters. The viewport is made to fill the child window, and its orientation is flipped on the y axis. Two simple lines are drawn along with a rectangle and an ellipse.

MyWndProc has support for the new *PRINT_FONT* message. *MyChildWndProc* has been expanded from a simple *DefWindowProc* call to handle the *WM_PAINT* and *WM_ERASEBKGND* messages. The *EraseRectangle* function has been added because all the previous erase functions were the same.

The changes to TOGGLE are relatively small, but it now has several additional functions. It is now more graphic than before.

Note that the *new_window* and *WinMain* functions are the same as in the initial version of TOGGLE (presented in the previous issue) and hence have not been repeated here.

Summary

Building a Windows application takes a good deal of support code to do anything. Incremental additions to a program are often easier to add. Including support for multiple windows of the same type tends to be easier than the supporting application-specific part.

The next part of this article will discuss dialog boxes and menus, completing the major tools available through Windows. This will be followed by the final part, which will touch on Windows support functions not related to graphics, including the Dynamic Data Exchange (DDE) protocol. §

Bill Wong is president of Logic Fusion, Inc., 1333 Moon Dr., Yardley, PA 19067, a systems software development firm. He currently has a book available through M&T Publishing, Inc. entitled Program Interfacing to MS-DOS. *The book is a reprint of ten articles that appeared in* Micro/Systems Journal *from May/June 1985 to November/December 1986.*

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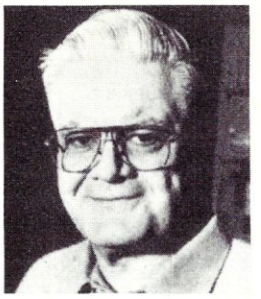

PCs, Ethernet, and Sun Workstations

Sun Update

In the May/June issue of *Micro/Systems Journal*, I reported on my purchase of a Sun 3/260 Workstation with Floating Point Accelerator (FPA) and my early frustrations and successes. The most important success was that my colleagues and I were able to run our three-dimensional, smoothed-particle hydrocode at 14 percent of the rate on a Cray XMP (for a code that was not vectorizable on the Cray). There were two main problems that had not been solved at the time I wrote that article, however.

One problem was that our default swapping partition of 16 Mbytes was too small and so we were not able to compile our hydrocode with optimized FORTRAN, having to make do with partial optimization, and even that did not work all the time. It was clear that we would have to repartition the disk, but I approached this problem with some trepidation because it is the equivalent of major surgery and I was still a newcomer to working with UNIX. Finally, the time came when one of my colleagues received his Sun 3/110 Workstation; I had promised that he could run diskless, running off my 280-Mbyte disk over the Ethernet, and I had to redo the disk to enable it to host the 3/110 in any case. The whole operation went very well, and we were only down for a few hours.

I made my swapping partition 32 Mbytes. Since then we have been able to run the hydrocode with full optimization most of the time, the exceptions being when quite a number of other processes are going on in the Sun workstation simultaneously and thus using swapping space. We have gained only a little bit of speed relative to the partial optimization, however. We now run at 15 percent of a Cray XMP.

The second problem I had at the time I wote the previous article was a difficulty with communication between my XT clone and the Sun workstation. As a temporary measure, we had set up Ethernet connections between my PC and the Sun workstation using two of the eight available ports of a Delni. This enabled communications, but extremely slowly—it took me 10 to 20 minutes to move a 300K file in either direction over this link with several time-outs along the way. Sun said we had to upgrade the ports on the Delni to cure this problem. Our Computation Facility management disagreed on the grounds that other 3Com Ethernet boards in PCs were operating successfully on the general Ethernet in our buildings without trouble.

To cut a long story short, the problem was cured by attaching a length of Ethernet cable to a third port on the Delni; the cable had an Ethernet transceiver on the other end, which supplied an additional signal needed by the Delni. The improvement was immediate and dramatic—it took less than 3 seconds to move that 300K file.

I think the bottleneck is now at the PC end because it has the slowest hardware in the system. The subsequent arrival of the Sun 3/110 was the trigger that led to our being hooked up to a real Ethernet, using this same Delni, and that went smoothly enough. It also allowed us to start using a second XT clone as a terminal on the Sun 3/260, using the PCNFS software, described in the next section, and the Ethernet.

With the extra space taken up by the swapping partition and by the host partition for the 3/110, and with our typical generation of several tens of Mbytes in output files per week, it was not long before the disk became full and disk management became necessary. We offload much of the output onto ¼-inch tape cartridges that hold up to 60 Mbytes. Because it will be necessary to have larger numbers of working files in the future, I have now obtained a second 280-Mbyte disk, which is mounted in the same pedestal as the first disk. Sun Microsystems fouled up the order by sending the disk but not the upgrade kit, and that took about a month to straighten out. The second disk is now installed and working fine. Fortunately, we did not have to remake the first disk for that installation—a little tinkering with the UNIX kernel, which was done by the field engineer, was all that was necessary.

PC Network File System

The basic philosophy behind the workstations sold by Sun and other vendors is that the workstations become part of a network. A few of the machines have large disks attached to them and act as servers; most of the others run diskless and are clients. The common denominator is Ethernet, and the common protocol is TCP/IP, which originated with ARPAnet.

Sun introduced its Network File System (NFS) in 1985 and placed it in the public domain. It has since been adopted by several other vendors. In Sun's case, the NFS is integrated with the UNIX kernel. It extends the UNIX *mount* command to allow users and system administrators to mount files and directories on their machines for use by others. This means that a mounted directory on another machine can be accessed as if it were on your own.

The network utilities I have so far found most useful are TELNET and FTP. TELNET is a program that attaches your terminal to another computer and allows you to log in if you have an account on the machine. Then you can do anything that you could do if the machine were your own. FTP means File Transfer Protocol; it is like TELNET in that it attaches your terminal to another machine and allows you to log in, but its primary purpose is to allow the transfer of files in either direction.

We have been using these facilities to access other Sun workstations at the Center for Astrophysics and also to access VAXen, and through one of the VAXen, to access ARPAnet. In this way we have sent

large files to and from Los Alamos at much faster rates than we were previously able to do by using a Bitnet connection to ARPAnet. FTP has allowed these files to be sent in real time, whereas Bitnet required them to be sent as electronic mail (they usually took about three days to be transmitted and sometimes did not arrive at all).

Sun sells a PC version of NFS, called the PC Network File System (PCNFS), that consists of a 3Com Ethernet card for the PC and associated software. The 3Com board and PCNFS cost $995 but are discountable for those with volume agreements with Sun. It was the operation of this PC system that gave us all the trouble involving the Delni, described earlier.

PCNFS is only a partial implementation of NFS because you cannot use it to access other PCs. The normal method of using it to transfer files between PCs would be for one PC to transfer the file to the disk of a Sun workstation and for the other PC to pick it up from there.

PCNFS has two main modes of operation. One mode is centered around the process of making Sun workstation resources available to you in your normal use of the PC. In this mode file systems that have been mounted on the Sun workstation attach to your PC as additional disks. Files can be copied to and from these extra disks in a normal manner. The process takes about the same time as it does on the PC, although it is often a bit jerky when the Ethernet gets tied up momentarily by another user. Normal file manipulation utilities often do not work properly on these extra disks, however. For example, XTREE allows me to display the tree structure and file names of the files on the Sun file system, but it does not allow me to copy these files. Sometimes a little confusion arises because UNIX allows longer file names and longer file-name extensions than does DOS, so the DOS displays of the files on the Sun file system truncate the longer names and attach unique endings onto them that bear no relation to the rest of the actual file name.

The other mode of operation of PCNFS is via TELNET. This mode is Sun-centered. TELNET allows your PC to emulate another terminal; the most common emulation is the VT100. You log into the Sun workstation and then proceed as usual to use the Sun computing environment. TELNET allows you to disconnect from the Sun workstation (without logging out) and to use DOS; you get back to where you were in the Sun environment using a hot key (normally Alt-T, but this can be changed).

UNIX ends lines with line feeds; DOS uses carriage returns and line feeds. Thus, PCNFS provides two utilities—UNIX2DOS and DOS2UNIX—which add or subtract carriage returns to/from ASCII files. This slightly dampens your enthusiasm for moving files back and forth between the two systems too often, using disk systems mounted on the Sun. The initial Version 1 of PCNFS lacked the FTP utility for transferring files. The new Version 2 of PCNFS does have FTP, and this has proven to be of great value, because it transfers ASCII files in either direction between DOS and UNIX formats "on the fly."

Another important use of PCNFS is for remote printing. I have transferred my Apple LaserWriter to the Sun 3/260. Now, when I want to process a TEX file, I TEX it, run the utility that converts the resulting DVI file to a PostScript file, and then send the PostScript file over the network for printing on the LaserWriter. On the Sun 3/260, the file is spooled for printing, and it is sent at 9600-bps over a serial link to the LaserWriter, just as I used to send it over a serial link from the PC. The advantage of this setup is that, whereas previously a large plot file took a long time to print and tied up the PC for a lengthy period, now the PostScript

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file is dispatched to the Sun in a few seconds and I quickly regain control of my PC. Another advantage is that the LaserWriter is now generally available to all the users of my Sun workstation who are connected to it over the network. A disadvantage is that Laserwriter error messages now do not automatically come back to be flashed onto my PC screen; instead, if my output does not come out on the LaserWriter, I must call up an error message log file to see what the problem is. It is better to check if the LaserWriter is out of paper before doing that.

PCNFS also has backup and restore modes that allow you to use the Sun workstation disk as a backup resource. We have never done this because we prefer to use Bernoulli Box cartridges for backup.

PCNFS has made it practical to include PCs on Ethernet networks. Just as businesspeople usually want to connect easily to an IBM mainframe, so scientists and engineers often want to connect easily to a number cruncher. In our case we have found additional benefits from the linkage. For example, it is often much cheaper to get specialized equipment for PCs than for Sun workstations. A full-size color screen for a Sun workstation costs $11,000 more than does a monochrome monitor (at list price), so we have chosen not to go that route. Instead, one of our XT clones has a NEC Multisynch monitor that allows us to operate in EGA mode. We bring over output files from the Sun workstation and make color plots of the output configurations. The ability to do this in color allows us to display much more interrelated information than would be possible with a monochrome display. I am expecting to get a film recorder that will attach to the PC and provide color slides of these displays. The corresponding facility for the Sun workstation would be enormously expensive.

The preceding discussion is a hardware example of the benefits of networking, but there are also many benefits on the software side. There is now an enormous reservoir of software for PCs. In contrast, people often complain that there is little software available for UNIX. This is more true in relative than in absolute terms, but it is certainly true that PC software can come in handy for working with UNIX output, and this is facilitated with the network.

Low-End Workstations

In my May/June column I also commented on the arrival of the Macintosh II (which uses 16.67-MHz 68020/68881 processors) and on its potential for use as a scientific workstation. It will be at least a year before UNIX will be available for this computer, so there is little incentive to rush right out and buy one. Also it is now clear that Apple will have some keen competition for the low-end workstation market.

One competitive product that gives comparable or somewhat superior performance is the Definicon coprocessor for the PC. This coprocessor board comes with a variety of options for CPU and memory. The most popular board is the Definicon DSI-780+/4, which has 20-MHz 68020/68881 processors and 4 Mbytes of memory. This board costs $3,595, and all software is extra. For more memory (up to 16 Mbytes) and faster speed (25-MHz 68020 and 20-MHz 68881 or the newer 68882 numeric coprocessor), you pay more on a rapidly rising curve so that performance/price decreases. Definicon Systems has promised to send me an evaluation coprocessor board, and I will report on it in due course.

Sun Microsystems has also invaded the low-end workstation market. Soon after Apple's announcement, Sun lowered the price of its 3/50 workstation. It now costs $4,995 and the 68881 numeric coprocessor is an extra $400 ($3,496.50 and $280 with discounts). This is a 15-MHz machine with 4 Mbytes of RAM that has a 1,152 × 900-pixel, 19-inch monochrome landscape monitor, and it must run diskless in this configuration. The essential software is bundled with this machine. If you add a 71-Mbyte disk and a 60-Mbyte tape cartridge drive, the cost is $9,995 ($6,996.50 discounted). Substituting a 141-Mbyte disk costs $1,500 ($1,050 discounted). This machine has no expansion slots, but it is clearly an important contender in this market.

These various options have a performance roughly equivalent to a VAX 11/780 but cost much less. Other workstations with comparable performance from other vendors cost significantly more but still well less than $20,000. I consider these low-end machines considerably better buys than presently available 386 machines for number-crunching purposes. §

A. G. W. Cameron is Professor of Astronomy at the Harvard-Smithsonian Center for Astrophysics.

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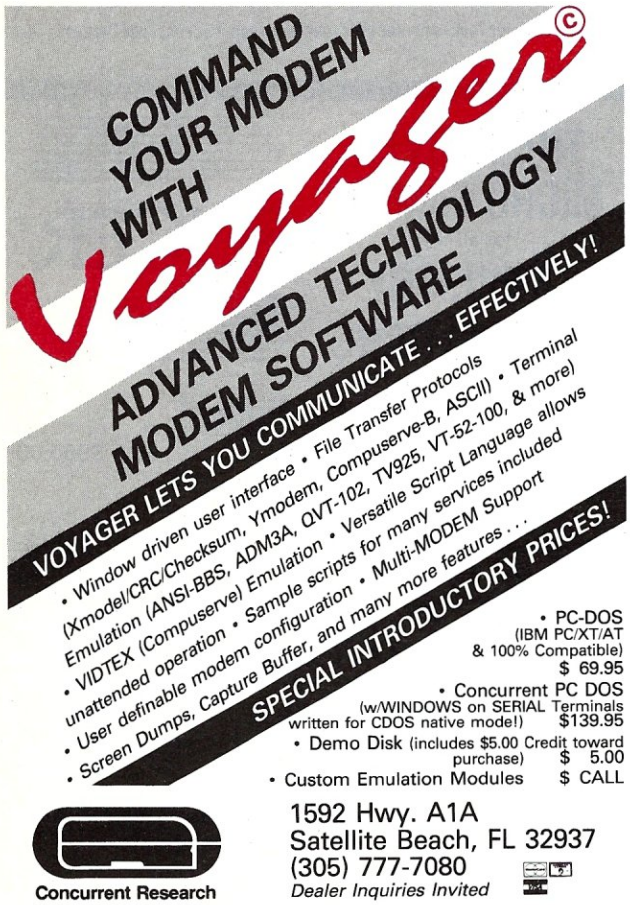

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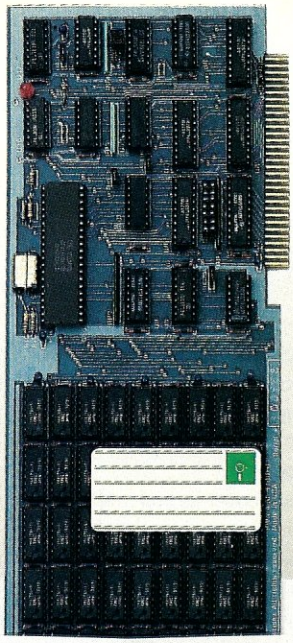

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LANScape

B. J. Hall & Michael Cherry

Previous LANScape columns have examined the basic concepts of local-area networks, including media and topologies. This article concludes our examination of these LAN basics.

Every field has its own jargon and slang, and the LAN field is no exception. The problem with this LANguage is that terms get interchanged or misused, and this leads to confusion. The objective of this article is to offer some baseline definitions of the most commonly confused LAN terms.

Interface Cards and Hubs

The Network Interface Card (NIC) is hardware that is installed in the workstation or file server. It provides the link between the workstation/file server and the communication medium (cable).

The Hub is hardware that provides a means to connect several workstations to the communications medium. This makes it easier to wire the LAN.

All this is not too complicated, except that rarely do two manufacturers use the same name to describe these items. As a result, there are many words that describe hardware that essentially performs the same function. Figure 1 illustrates some of these different names for NICs and Hubs.

It is probably easiest to agree on a "generic" name for all these items. At HallComm we use Network Interface Card and Hub because they describe the roles perfectly and, therefore, describe the items.

Compatible and Emulate

The words *compatible* and *emulate* cause the same problems in the LAN environment as they do in the microcomputer environment.

Let's start with compatible. An accepted definition of compatible is probably now both meaningless and impossible to agree upon. Compatible has come to mean "as good as an IBM/PC (XT or AT)." What we really mean is the item that is compatible will "pretend" to be something it is not. In the case of an AT compatible, we mean the compatible pretends to be an IBM PC/AT. Usually, it does not stop there; rather, we expect benefits to be added to the pretending—for example, we say not only is it AT compatible but also it is even faster. The catch with a compatible is that it is compatible only to the extent that it exactly matches the behavior of the item with which is compatible. In most cases there is something that the compatible does not do properly, and in most cases this noncompatibility never comes to light. Unfortunately, the LAN is often the place where you discover the incompatibility—that is, you find where the pretending fails. Almost everyone is now cautious about compatibles and wary about the problems that can arise with PCs that are not totally compatible.

Emulate is a word with a similar meaning, but everyone treats it differently. Emulate also means pretend. Typically emulate comes into play when we discuss communications and terminals—for example, hardware and software are available to emulate an IBM 3278 terminal (usually a 3278 Model II). The problem is that emulate again means pretend. Special hardware and emulation software allow the workstation or PC to pretend to be a 3278 terminal.

But just how good an acting job can the workstation perform? Consider that the PC has a different keyboard from that of the terminal it is pretending to be. Simply put, the PC has 10 function keys whereas the 3278 has 24 (program) function keys. Right away the PC is in trouble. It does not have enough keys to pretend to be a 3278 terminal correctly.

The solution is that the emulation must remap the keyboard, and the success of the emulation (pretending) depends upon how well the remapping is performed. The very fact that remapping is necessary shows that the emulation is at best a trade-off. To those of us who work with LANs, it must be remembered that compatible and emulate mean there will be trade-offs. To get the full functionality, go with the real

Manufacturer	Topology or Protocol	Network Interface Card	Hub
AT&T	Starlan	Network Access Unit	Network Exchange Unit (NEU)
Gateway	G/Net	Network Interface Module	N/A
IBM	PC Cluster	Adapter Card	N/A
IBM	PC Network	Adapter Card	Base Expander Eight Way Splitter
IBM	Token-Ring	Adapter Card (I,II,A)	Multiple Access Unit (MAU)
Nestar	Net 2000	Network Interface Card	Line Isolation Device
Novell	RX-NET	Network Interface Card	Active and Passive Hub
Proteon	Pronet10	Network Interface Board	Wire Center
Standard Micro Systems	Arcnet	Network Interface Card	Active and Passive Hub
3Com	Etherlink	Network Interface Board	N/A

Figure 1. NIC and Hub names used by LAN manufacturers

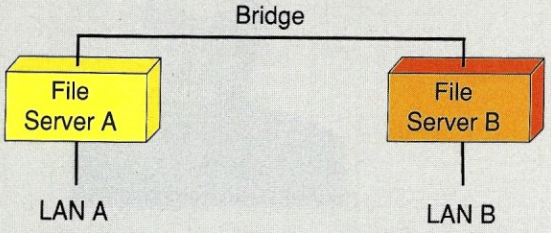

Figure 2. Internal bridge

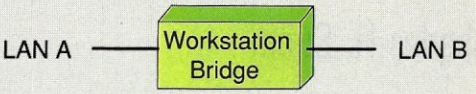

Figure 3. External bridge

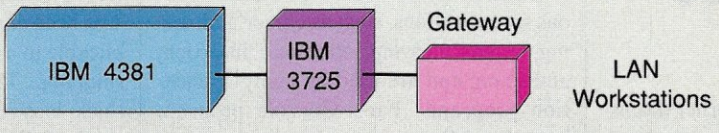

Figure 4. A typical Gateway

thing. If you can save money or there is another substantial advantage, use the compatible or emulator, but consider the trade-offs.

Token Ring

The words *token ring* are creating their own confusion in the world of LANs. Lots of people refer to token ring as if there is token ring hardware and software. We are not aware of any specific token ring software. Token ring is defined at HallComm as a topology and protocol for connecting workstations and file servers together on a network. It describes the use of a token to control access to a medium and the ring topology of that medium.

The software that IBM sells in conjunction with its Token-Ring hardware is the IBM PC LAN program (currently, Version 1.2). This software works on the IBM PC Network—it is not restricted to IBM Token-Ring hardware. Novell's NetWare and Banyan's Vines also run on token ring hardware (from both IBM and Proteon). Are they therefore "token-ring software?"

Bridges and Gateways

Two other words that get interchanged in discussions of LANs are *bridge* and *gateway.*

At HallComm, we use bridge to describe link between two LANs. Until recently, this was usually a short-distance link between two LANs, but thanks to new equipment, X.25 networks can be used to bridge LANs regardless of distance.

What does the bridge look like? Well, there are two forms—internal (when the bridge is housed within the file server) and external (when the bridge is housed in a special workstation). Figure 2 illustrates an internal bridge, and Figure 3 shows the external bridge between two LANs.

Purists may argue that a bridge is the link between two networks of a similar protocol—for example, a link between two LANs with the same protocol or topology (such as Ethernet to Ethernet).

A gateway is defined at HallComm as a link between two different protocols. This is a growing feature or requirement of LANs, especially gateways to IBM mainframes. Such a gateway might appear as shown in Figure 4. This gateway would allow the user of a workstation on the LAN to access the IBM host (by emulating a 3278 or 3279 3GS terminal). Gateways exists between LANs and a wide variety of asynchronous and synchronous hosts.

As stated earlier, the objective of this article is to clarify the use of some confusing LAN terms. These terms by no means represent all the words that cause confusion with LAN users and developers. Like all computer systems, LANs have their share of acronyms that contribute to further confusion.

What can be done? Manufacturers will continue to give their own names to hardware and software that provide similar functions. New acronyms will continue to be created. Old words will take on new meanings.

When speaking about LANs, we owe it to the people we are communicating with to verify that we are all using the words in the same way and that our audience understands the words in the context of the LAN. When listening, we need to ask questions or seek clarification to ensure that we understand how the terms are being used. To do less is to fail to communicate, and communications is what LANs are all about!

Next Month: NETBIOS §

B.J. Hall and Michael Cherry operate HallComm Network Services, a company devoted exclusively to designing and implementing LAN systems. HNS is located at 8101 E. Prentice Ave., Ste. 304, Englewood, CO 80111; (303) 770-6387.

The Public Domain Software Forum

by Charles H. Strom

A Look at Two Outstanding PDS Programs

I would like to continue my earlier discussion pointing out more noteworthy programs in the public domain.

Fansi-Console

Fansi-Console is a fast ANSI screen driver for the IBM PC and compatibles. It is designed to replace two already existing pieces of code in the computer—the console firmware residing in the BIOS and the standard ANSI device driver ANSI.SYS that comes on the MS-DOS disks. Why replace these vital links between the computer and the user? Simply put, Fansi does much more and does it much better.

The program installs during boot time as a device driver. In other words, you must edit your CONFIG.SYS file to include the command to load FCON.SYS (the name of the actual device driver) with the appropriate parameters. Fansi stays memory-resident for the duration of the session. It occupies about 32K, as opposed to less than 2K for ANSI.SYS, but the improvements make the memory investment well worthwhile. I will cover the program's major features.

The primary feature of Fansi-Console is the upgraded speed of writing characters to the screen. All programs that use MS-DOS or BIOS calls (rather than writing directly to the hardware) will benefit significantly. Indeed, installing Fansi will make you think that you have just installed an expensive accelerator board! Speedup depends on the type of display card installed. The biggest improvement is noted when using the Color Graphics Adapter (CGA), though monochrome and Enhanced Graphics Adapter (EGA) cards also benefit.

ANSI.SYS is Microsoft's attempt to emulate the ANSI X3.64 cursor-control sequences. These sequences control various screen actions, such as cursor addressing, screen clearing, character insertion, and so on, and are used by many application programs. Fansi-Console program has taken Microsoft's limited implementation and tremendously expanded it to include nearly the entire ANSI standard. In fact, a large fraction of the Fansi manual addresses the X3.64 standard and its implementation in the software.

Fansi-Console can convert both the function keys and the numeric keypad of an IBM or compatible to look like a Digital Equipment Corp. VT-100. Coupled with ANSI control sequences (used by the VT-100), you have an excellent terminal emulator useful for mainframe communication.

Fansi can be configured to place the last n lines of terminal output into a circular memory buffer for recall at will using the scroll-lock key. Recalled lines can be printed, written to a file, or entered as a console command. A recent enhancement allows use of expanded (LIM) memory for the recall buffer, thus freeing up valuable system memory.

There are so many extras built into this program that it becomes necessary to abbreviate the balance. Fansi allows expanded keyboard type-ahead, screen blanking after a user-specified duration of no keyboard activity, a keyboard macro facility, elimination of CGA screen blinking, key-click adjustment, repeat rate, and more.

Fansi-Console is written and distributed by Mark Hersey of Hersey Micro Consulting, P.O. Box 8276, Ann Arbor, MI 48107; (313) 994-3259. Mark has a variety of distribution routes. The software is available as shareware from IBM areas on CIS and GEnie and a plethora of smaller remote systems (look for a file called FCON???.ARC). Mark also maintains a remote system of his own ([313] 994-3946, 300/1200-bps) for distribution, technical support, and patch information. The licensing fee is $25 plus shipping, applicable to a full package price of $75 plus shipping. This latter option includes a thick loose-leaf manual covering all aspects of Fansi-Console setup and operation in excruciating detail. The shareware files and disks have an abbreviated document file. Mark has recently been distributing his product through dealers as well, so he is covering all bases. I urge you to register your product with Mark. The price is more than reasonable for such a useful utility, and only by supporting authors of superior products such as Fansi-Console can we assure the continued success the of shareware concept.

Qedit

Have you ever wished for a fast, compact editor with WordStar-compatible key functions? Qedit might well be the answer. This editor is distributed under the shareware concept and is available via the usual remote systems and commercial services. You can reach the author at Semware, c/o Sammy Mitchell, 136 Mark Lane, Smyrna, GA 30080.

Qedit is designed from the ground up to be fast. Written in Turbo Pascal and assembly language, Q.COM is a 39K file that has no overlays; files to be edited are restricted to what will fit in memory. Sammy did not initially design the program to be WordStar-compatible, but he supplies several alternate keyboard configuration files, including a WordStar-like set and a user-definable set. The easy-to-use install program inserts the appropriate key definitions from these files as well as sets colors, reserved memory, several initial defaults, and so on. Qedit offers a split-screen mode allowing the simultaneous viewing and editing of two files in a

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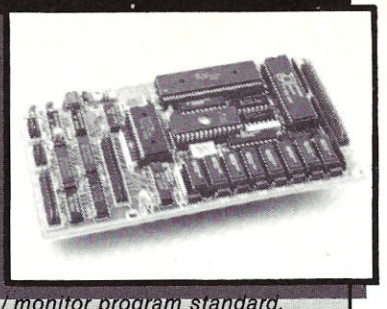

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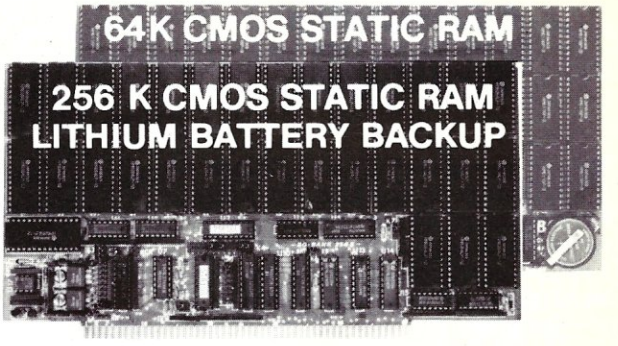

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horizontally split screen. The separator between the two windows can be shifted to change the relative sizes of the two windows. Actually, more than two files can be brought into memory (assuming they fit), though only two are visible at a time. It is a simple matter to press ^KN to bring the next RAM-resident file onto the screen. The editor also provides for up to 99 scratch buffers (a bit of overkill?).

Qedit is an ideal all-purpose editor for quick jobs and has enough functionality to satisfy most needs. Find, find/replace, print, jump to a specified line, word wrap, shell out to a DOS command, and block operations are all supported. There is even an *UNDO* command that can restore a line as long as the cursor is not moved away from it. WordStar could not even boast an *UNDO* until Version 4 arrived!

I don't suggest that Qedit is a replacement for WordStar, but at $30 for registra-

New PC/Blue Releases

The following are the most recent releases in the PC/Blue library of public-domain MS-DOS software. The PC/Blue disks are available from the New York Amateur Computer Club Inc., Box 106, Church Street Station, New York, NY 10008, for $7/volume (includes media, shipping, and handling); foreign orders, add $2/volume.

Volume 290
AsEasyAs, Version 2.05—Lotus 1-2-3 "clone, 1,024r × 256c"

Volume 291
Desk Management Utilities "SideKick clones"
DeskTeam, Version 1.03
Right Hand Man, Version 3.3

Volume 292
Kermit, Version 2.29B—modem communications system (replaces PC/Blue 246)

Volume 293
XANADU Utilities—HDIR, PCSTAT3, and SFIND
POPEDIT—memory-resident screens
FORTH TUTOR (with F-83 Forth)
SMALLDOC—document printer

Volume 294
CALC V3.01—calculator with graphing capability
CITYDESK V2—newsletters on dot-matrix printers
LPTX V6.00—line-printer output capture routines

Volume 295
Program for Simple Algebra—PFSA (updates PC/Blue 166)

Volume 296
The Brown Bag Collection (Volume 1 of 3)
HomeBase v2.0—desktop organizer

Volume 297
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HomeBase v2.0—desktop organizer (starts on Volume 296)

Volume 298
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Volumes 299-301
RBBS-PC Version 15.1A—remote bulletin-board system

Volumes 302-303
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Volume 304
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tion and a disk including the next major update, it is certainly a bargain. Incidentally, the source code is available to registered users at additional cost. The best part is that the shareware nature of the product allows you to try before you buy! If you do indeed agree with me that Qedit is a winner, please show Sammy your support by registering. Only in this way can we keep the shareware concept alive.

That wraps things up for this month. I am in no danger of running out of ideas, but if you have particular areas of interest you would like me to explore, please let me know about it! §

Charles Strom has been working with microcomputers for more than ten years. A chemist by training, he is a computerist by choice. He is a sysop on the GEnie national time-sharing service.

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Still River Shell v1.82—enhanced system environment for files and directory (updates PC/Blue 201)
Tdraw v2.10—color screen image text editor
Color Utility—screen color changer

Volume 308
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Aquarium—turn your PC into a fish tank
Tic-tac-toe game

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Freemacs—Emacs editor
Ezcount—word counter

Volumes 310 - 311 (two volumes)
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PC-Style—writing analyzer
PC-Type—dictionary file (program on Volume 313)

Volume 315
The Buttonware Collection (Volume 4 of 6)
PC-Dial—communications program
PC-Graph—PC-File graphing utility

Volume 316
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The UNIX File

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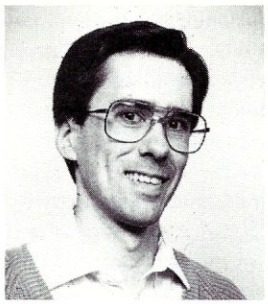

This column discusses the UNIX operating system. If you have comments or questions about UNIX or this column, please write to Ian Darwin at Box 603, Station F, Toronto, Ontario, Canada M4Y 2L8. If you have UNIX mail access to the uucp network, mail "ihnp4!darwin!ian." Internet users should try "ian@sq.com" or "ian@darwin.uucp." I can't always answer immediately, but I will get back to you; electronic mail gets answered first!

From: ian@darwin. (Ian F. Darwin)
Date: Fri, 6 Sep 85 09:23:26 EST
Newsgroups: general,net.news,net.general
Subject: Ancients predict USENET
Message-ID: <52@darwin.UUCP>
Path: darwin!ian
Distribution: net.general

The pupils of the Tendai school used to study meditation before Zen entered Japan. Four of them who were intimate friends promised one another to observe seven days of silence.

On the first day all were silent. Their meditation had begun auspiciously, but when night came and the oil lamps were growing dim, one of the pupils could not help exclaiming to a servant: "Fix those lamps."

The second pupil was surprised to hear the first one talk. "We are not supposed to say a word", he remarked.

"You two are stupid. Why did you talk?" asked the third.

"I am the only one who has not talked", concluded the fourth pupil.

—#71 in *101 Zen Stories*,
Paul Reps, editor

It's about two years since I got up one Friday morning and posted this article to the entire USENET community, the collection of UNIX and other computer systems linked by the uucp-based Network News facility. I meant it as a comment on the inane and repetitive quality of many of the articles appearing on the net. Almost everyone was able to grasp the meaning in it.

The problems of USENET are both technical and personal. The technical problem is that several days can elapse between the time an article appears and the time the follow-ups about the article begin to appear. The result is that many people post follow-up articles that duplicate each other, just as do the student monks in the story. The personal problems are people's inability or unwillingness to think calmly before posting a follow-up, their refusal to spell things out in full (forgetting that there is no accompanying "body language" and intonation to convey intent), and their refusal to grant the other person the benefit of the doubt.

Notwithstanding these problems, USENET continues to provide a useful service. Most net users go through an early phase of adoration, which eventually turns to churlishness with the realization that there is so much wasted breath. Some people give up on the net at this point; others persevere. With time, those who persevere learn to separate the wheat from the chaff and find that there is indeed intelligence behind some of the keyboards out there.

One solution to the problems of USENET is education. I've mentioned earlier the book *Toward an Ethics and Etiquette for Electronic Mail*, (UNIX File, March/April 1986 issue) in addition, the news group "news.announce.newusers" contains useful information about using the system well.

Another solution is to parody the situation, as I did that Friday morning in 1985. Not for its redeeming social value but for the amusement of those who have been using USENET for a long time, there is now a C program to generate more informal parodies. I obtained it, of course, over USENET itself. The program reads a series of USENET articles and generates a parody of them. The idea of parody programs is not new. Several parody programs have been written for UNIX; this one is by Joe Buck of Entropic Processing, in Cupertino, California. It can be freely copied; let me know if you want a copy.

Buck's program uses the mathematical notion of "Markov chains," which very simply provide a way of producing on output lists of words that are similar to those in the input file. To quote the documentation: "*Markov3* digests Usenet articles and builds an internal data structure that models the articles as if they came from a random process, where each word is determined by the previous two. It then emits a series of articles on the standard output that have the same distribution of words, word pairs, and word triplets as do the input files. The name *markov3* comes from the fact that this structure is called a Markov chain, and that the statistics for word triplets are modelled."

What does this mean? In a nutshell, this program reads in text files and produces plausible-sounding nonsense. The effect is to put together bits and pieces of the input articles to make a new article that sounds something like each of its input articles. As an example, I ran *markov3* on a few smatterings of the USENET groups about desktop publishing and about UNIX itself. Here's the best of what it produced:

- I'm trying to find out about hardware/software products that provide ethernet TCP/IP access to the noise . . . .
- This request piqued my interest. I looked to see that dbx now has support for 8 users. + + This box is produced by a sed script).
- Since I did 'ioctl(gtout, EGAIO, gports)' (gtout is the moderator, it breaks because user.h includes resource.h explicitly!
- In some article . . . @mimsy.UUCP (and why is not necessarily touched during the write( ). There isn't any question of data "going" anywhere; it's just bit patterns in memory and the software was getting lost.. Moral: move the old kernel to vmunix.old and the new drivers have the

same name as the old?

- Item scanned doesn't move . . . like on a Mac and on an offset press—and that will probably smoke the machine (happened to ours at work). So what you have to look for is how many copies the machine will handle in a separate list. The Euler fonts are in a Desktop Publishing system offering significant improvement in throughput, image quality, and flexibility.
- Back to the distribution as soon as possible.
- I've read the man pages in section 3, the other hand, as long as the technology so advanced as to appear as supernatural. A spacefaring race gets a ship lost and makes a forced landing at a planet hitherto avoided for sociological reasons (it is inhabited by primitives who are not to be included in, simply make every .h file to look in the user struct, we reserve a spot in the middle. This hanging seems to be no problem, they even provide a VT100 emulator that runs in Sun Windows.
- The solution: (Help?)
- There is no statute of limitations on stupidity.

UNIX on Low-Cost Graphics Workstations

Several low-cost graphics workstations with UNIX are now available. By now it is old news that Apple has announced the availability of a fairly standard System V port for the Macintosh II, with shipment later in 1987. This is good news for those who favor System V as a standard as well as for those who want to see how UNIX fares in the Macintosh marketplace. The UNIX offering will be an optional extra; it will not replace the Macintosh operating system but will extend it, allowing simultaneous UNIX and Macintosh capabilities.

On an even lower budget, a UNIX clone for the Atari ST is now available. Computer Tools International has announced a port of the IDRIS operating system for the Atari 520ST and 1040ST computers. IDRIS is the first UNIX clone that I know of; it was originally cloned from V6 UNIX many moons ago. P. J. Plauger left Bell Labs to found Whitesmiths Ltd., whose two main products are a C compiler (plus a Pascal-to-C translator that is the first phase of its Pascal compiler) and the IDRIS operating system. IDRIS has been around a long time—almost a decade—undergoing steady evolution. There was even talk around 1980 of a Z80 version of IDRIS, but I don't think that that ever became a product. IDRIS does run well on small systems (LSI-11s, 68000s, and so on). It's often sold for use with applications embedded in other products as a ROM-resident UNIX kernel.

Computer Tools International claims that its version of IDRIS is compatible with the 1984 /usr/group standard for UNIX-like operating systems. That standard is the forerunner of the present IEEE POSIX standard for UNIX and is fairly close to System V as well (AT&T had representatives on the committee that produced the 1984 standard as well as on that of the POSIX group). The IDRIS product includes the System V InterProcess Communication.

Other features claimed by Computer Tools International include true multitasking and multiuser operation; extra support for real-time applications; C and Pascal compilers (including libraries, assembler and debugger, and Pascal-to-C translator); a C graphics library (VDI output functions for the Atari); the Ctext formatter (similar to, but not compatible with, nroff/troff); and support for the Atari's modem, printer, and MIDI ports.

An Atari ST computer with this software should make a reasonably good UNIX-like graphics workstation: the company claims that "an Atari ST computer with [the] Idris operating system constitutes the lowest-priced UNIX-based graphic workstation available." The base system costs $400; the C/Pascal compilation system is another $200, and Ctext is another $200. For information, contact Computer Tools International, 720 S. 333rd St., Ste. 101, Federal Way, WA 98003; (206) 838-4990.

That's all for this column. I welcome letters and electronic mail on these and other topics, including suggestions for future columns. §

Ian Darwin is Director of Research and Development for SoftQuad Inc., Toronto, developer of quality UNIX-based publishing software. He previously administered UNIX systems and organized and taught the undergraduate UNIX course at the University of Toronto.

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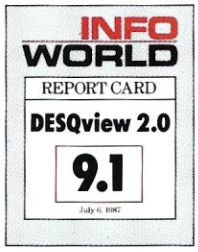

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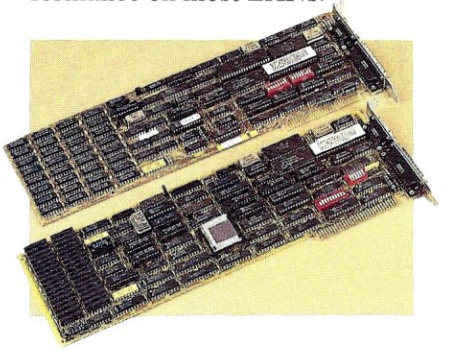

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We put the computing engines all in one place — in the server. Not spread all over the building. The easiest software installation of any LAN. Use PC-PLUS with your choice of AT compatible servers. Add a card and terminal to grow. Simple RS-232 data cables — no expensive rewiring with coax. You can often use existing telephone cable. Convenient packaged solutions, with preconfigured hardware and software.

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Our network operating software runs most popular software — like Lotus 1-2-3 and word processors. And the multiuser software that runs on Novell, IBM and 3COM networks — like dBASE III PLUS w/LANpacks, R:BASE System V, the SMART Series, Revelation.

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A local area network is a long term investment. Today's applications are just the beginning. Make sure your choice is ready for tomorrow — with mainframe connections, remote access, graphics and the power for growing database applications. Find out more about PC-PLUS today. Ask for our free 24 page brochure "**Choosing the *Right* LAN,**" and get all the facts you need for a wise investment.

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Alloy Computer Products, Inc., 100 Pennsylvania Avenue, Framingham, Massachusetts 01701. (617) 875-6100, TWX: 710-346-0394

Alloy Computer Products, Inc., 9 Executive Circle, Suite 240, Irvine, California 92714. (714) 261-7661